PAPERS OF THE ROYAL COMMISSION ON POPULATION

VOLUME II

REPORTS AND SELECTED PAPERS OF THE STATISTICS COMMITTEE

LONDON: HIS MAJESTY'S STATIONERY OFFICE
1950

ROYAL COMMISSION ON POPULATION

Report

Cmd. 7695

CORRIGENDA

Page 5, Table I
For—" Great Britain 49 "
Read —" Great Britain 48 "

Page 10, Table V, Births, 1900-11
For—" 10,956 "
Read—" 10,596 "

Page 10, footnote to Table V
For—" 671,000 "
Read—" 651,000 ".

Page 24, Table XV—Heading
For—" 1841-1870 "
Read—" 1841-1865 "

Page 25, Table XVI—Heading
For—" 1900-24 "
Read—" 1900-29 "

Page 26, paragraph 63, ninth line
For—" (20 per cent) "
Read—" (12 per cent) "

Page 45, paragraph 111, thirteenth line
For—" (2) "
Read—" (3) "

Page 54, paragraph 133, tenth line.
For—" Table XXXIX "
Read—" Table XXIX "

Page 67, Chart II
For age-group 65-70 the higher of the two lines should be heavy, not the lower

Page 68, Table XXXII, column (1), first line
Attach footnote to figure 0, as follows " Infant mortality rate (deaths per 1,000 live births) "

Page 70, Table XXXIII, under heading " Excess of column (3) over column (2) —Numbers
For—" 242 "
Read—" 245 "

Page 83, paragraph 208, third line
Delete—" , e.g ,"

Page 94, Table XLV, 1947.
For—" 48 4 "
Read—" 48 2 " under the three headings where it appears

Paragraph 235, fifth line.
For—" projection "
Read—" projections "

Page 96, Table XLVIII and Table XLIX, 1947.
For—" 48 4 "
Read—" 48 2 "

Paragraph 239, fifth line.
For—" Table XLVIII "
Read—" Table XXXVIII "
Table XLIX, second line
Delete comma after " intermediate ", insert comma after " 1942-47 "

Page 128, Table LI, Total Population (millions), Northern Ireland, 1931.
For—" 1 3 "
Read—" 1 2 "

Total for Gt Britain and Northern Ireland, 1931.
For—" 46 1 "
Read—" 46 0 "

Page 140, paragraph 376, ...
For—" column I "
Read—" column II "
Sixth line
For—" column II "
Read—" column III "

Page 152, paragraph 408, tenth li
For—" XXIX "
Read—" XXX "

Page 156, paragraph 417, fourth line
For—" para 403 "
Read—" para 413 "

Page 195, paragraph 540, eighth line.
After—" Biological "
Insert—" and "

Page 198, paragraph 552, tenth line.
For—" 53 "
Read—" 51 "

Page 228, paragraph 658, last line but two.
After—" earned income "
Insert—" up to £1,000 plus one-twentieth of any earned income "

Page 233, paragraph 688, last line
Insert comma after " Hajnal "

Page 238, List of Members of Economic Committee.
After—" Professor Sir Alexander Gray, Kt., M.A."
Delete—" , J.P."

Page 239, Appendix 2, Eugenics Society.
For—" Dr. Aubrey Lewis, M.D., F.R.C.P."
Read—" Professor Aubrey Lewis, M.D., F.R.C.P."

Page 240,
After—Kuczynski, Dr. R. R
Insert—" Lewis, Professor A. J., M.D., F.R.C.P."
For—" Mackintosh, Professor James M , F.R.C.P., M A., M.D."
Read—" Mackintosh, Professor James M , M.A., M.D., F.R.C.P

Page 243, footnote, first line.
For—" footnote (1), page 4 "
Read—" footnote (2), page 242 "

Page 244, footnote (4), second and third lines.
For—" footnote 2 on page 10 "
Read—" footnote (4), page 245 "

Page 245, paragraph 13, last line
For—" animal "
Read—" annual "

Page 258, ninth line.
For—" $82.4 - 88.7 \times 395 = 367$ "
Read—" $(82.4 - 88.7) \times 395 = 367$ "
Paragraph 11, fifth line.
For—" 755 "
Read—" 734 "
Paragraph 13, fourth line.
For—" 0.855 "
Read—" 0.0855 "

Page 259, Table X—Heading.
For—" Proportion of legitimate to illegitimate births (per cent.) "
Read—" Proportion of illegitimate to legitimate births (per cent.)

LONDON: HIS MAJESTY'S STATIONERY OFFICE

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MINUTES OF APPOINTMENT

25th February, 1944

I hereby appoint—

A. M. CARR-SAUNDERS, ESQ., M.A.
V. P. A. DERRICK, ESQ., F.I.A.
Dr. D. V. GLASS, B.SC., PH.D.
R. R. KUCZYNSKI, ESQ.
J. G. KYD, ESQ., C.B.E., F.F.A., F.R.S.E.
H. CAMPION, ESQ.
A. REEDER, ESQ., O.B.E.
PERCY STOCKS, ESQ., M.A., M.D., D.P.H.
F. A. A. MENZLER, ESQ., B.SC., F.I.A., M.INST.T.
G. H. MADDEX, ESQ., F.I.A.

to be a Committee to formulate for the assistance of the Royal Commission on Population the statistical particulars necessary for the Commission's inquiry and generally to advise the Commission on the statistical aspects of the inquiry.

I further appoint Mr. A. M. Carr-Saunders to be Chairman of the Committee, Mr. N. F. McNicoll to be Secretary and Mr. W. A. B. Hopkin to be Assistant Secretary of the Committee.

HENRY WILLINK

4th January, 1945

I hereby appoint

MR. D. G. CHAMPERNOWNE, M.A.,

to be a member of the Committee to formulate for the assistance of the Royal Commission on Population the statistical particulars necessary for the Commission's inquiry and generally to advise the Commission on the statistical aspects of the inquiry.

HENRY WILLINK

CONTENTS

TO THE RIGHT HONOURABLE ANEURIN BEVAN, M.P., Minister of Health

1. We were appointed by your predecessor on the 25th February, 1944, with the following terms of reference:—

> To formulate for the assistance of the Royal Commission on Population the statistical particulars necessary for the Commission's inquiry and generally to advise the Commission on the statistical aspects of the inquiry.

We have met 62 times in full Committee and there have been numerous meetings of sub-committees constituted to deal with particular subjects.

2. In November, 1947, to our great regret, we were deprived by death of the assistance of one of our members, the late Dr. R. R. Kuczynski.

3. It will be observed that our terms of reference direct us to advise the Royal Commission on Population and do not call specifically for any report otherwise than to the Royal Commission. We feel however that it is proper for us to report to you on the way in which we have discharged the duty placed upon us. The character of our work has in fact been entirely determined by the fact that our prescribed task was to advise the Royal Commission. To carry out this task meant that we had to give advice on particular problems as they arose in the course of the inquiry. At one time we hoped that in addition we should prepare a single comprehensive report covering systematically the whole field of British population statistics. As matters have turned out, it would have been impossible to do this with the resources at our command unless more immediate duties had been neglected. In the course of our work we have however accumulated a body of material, some of which we think may be of interest to a wider public, and we print in the present volume a series of papers selected from this material. Some of these papers are our own reports to the Royal Commission, others are memoranda prepared for us by members of our secretarial staff, government departments, or other persons. We are well aware that these papers do not cover the whole of the subjects on which we were directed to advise the Royal Commission (though between them they do in fact cover a great part of the field). The assistance we have tried to give the Royal Commission has not been offered exclusively in the form of written memoranda. Some has been given by way of oral contributions by our Chairman, speaking on behalf of the Committee to the Commission, and some by way of scrutiny and criticism of drafts of sections of the Royal Commission's own report. Thus the sphere of our work is by no means coincident with the scope of the papers which follow; for on the one hand much of our work finds no expression here, and on the other hand many of these papers are not in any sense our work. We believe that the publication in one volume of this series of memoranda on distinct but allied subjects within the field of British population statistics is justified by its value to students of the subject. In the following paragraphs, the main purpose of which is to describe how we have sought to fulfil the duty laid upon us, we shall attempt incidentally to indicate the origin of each of the papers printed in this volume.

4. Our first task was to prepare a brief statistical account of the trend of population in Great Britain as an introduction to the subject for the members of the newly appointed Royal Commission. This short report, prepared in great haste, was intended for a specific purpose. It is now seriously out-of-date and we have not thought that the preparation of a revised version for publication would be justifiable in view of the fact that a non-technical exposition of the subject is available in the report of the Royal Commission itself.

5. Following the completion of this report, we made a careful examination of the statistical information available to meet the needs of the Royal Commission's inquiry. We came to the conclusion that in certain respects it was seriously inadequate, and we recommended that a special Family Census should be held at an early date to fill the gaps. The Royal Commission thereupon asked that facilities should be granted to enable such a Census to be taken. We took part in the subsequent discussions with the Treasury and other government departments which led eventually to the taking of a sample Family Census in January and February, 1946. We have since been kept informed by the Statistical Director and Assistant Statistical Director of the Census (respectively Professor D. V. Glass and Mr. E. Grebenik) of the progress made in the analysis of the material, and we have from time to time considered their plans and offered our comments and advice for their consideration. We are glad to be able to include in this volume their preliminary report on the results of the Census.

6. Our next piece of work was stimulated by the striking and largely unexpected increase in the number of births which took place in Great Britain after 1941 and which at the time was beginning to attract attention. The Royal Commission were naturally anxious to know what light statistical analysis could throw on the causes of the higher numbers of births and on their probable duration. We had received from the General Register Office much valuable material relevant to these problems, and we also initiated a detailed study by our Assistant Secretary, Mr. Hopkin, and our research assistant, Mr. Hajnal, of the statistics of births in the period 1939–43. On the basis of this work we prepared a report for the Royal Commission on the population statistics of the period up to 1943, with special reference to the explanation of the increase in the number of births between 1941 and 1943. This report is now out-of-date. Much information relevant to the explanation of the events treated is now available that was not available then, both in the sense that with the lapse of time we now have statistics for the whole war period and not simply for the years 1939–43, and also in that we now have the additional information provided by the Family Census. We have therefore decided not to publish this report, but we include in this volume the memorandum written for us by Mr. Hajnal as part of the basic material from which it was prepared. We think this memorandum will be of interest to students of population statistics as an exercise in the technique of detailed fertility analysis.

7. In the course of the discussions which culminated in this report, we had to recognise that the influence of changes in marriage habits on the trend of births had become so important as to require very careful analysis. As a contribution to this analysis, the Government Actuary's Department constructed a " standard population " of married women by age and duration of marriage, and applied it to calculate " nuptial-standardised " reproduction rates. Their memorandum on this subject is printed below. Mr. Hajnal also prepared a memorandum for us on " Recent Trends in Marriage in England and Wales," which was later published, with our consent, in the first issue (June, 1947) of the Journal *Population Studies*(1).

8. Both these studies contributed to suggest a re-examination of the problem of measuring reproductivity, a problem on which we had discussions from time to time throughout the period of our work. We also received interesting papers on the same subject from the General Register Office. At a late stage in our work we put in hand the preparation by Mr. Hajnal of a

(1) Aspects of Recent Trends of Marriage in England and Wales, *Population Studies*, Vol. I., No. 1.

memorandum discussing the problem in some detail as it presents itself in the circumstances of the present day. His report ("*Births, Marriages and Reproductivity, England and Wales*, 1938–1947") is printed below. Much of it represents Mr. Hajnal's original work and it must as a whole be regarded as his personal contribution to the discussion of the subject. We are glad to give it a place among our papers as a study worthy of serious attention.

9. In recent years the trends of population have thrown up a number of difficult problems for statistical analysis, and the whole technique of such analysis and in particular of measuring reproductivity is in the melting-pot. In such circumstances there have inevitably been divergences of view between members of the Committee. The view of the majority of the Committee on these subjects is set out in general terms in the Introductory Memorandum which follows this Preface, and it is accompanied by a statement, immediately following the Memorandum, containing reservations thereto from two of our members.

10. During the preparation of the Report of the Royal Commission, draft Chapters covering most of the ground now covered by Chapters 2–9 of that Report were submitted to us for comment. Several of these chapters were subsequently modified by the Royal Commission, in some instances to meet suggestions made by us and in others to incorporate fresh material which became available to the Royal Commission (e.g. from the Family Census) and the conclusions derived by the Royal Commission from this further material. In the case of one Chapter (Chapter 7 on Replacement) the additional matter incorporated in this way was of considerable importance. It included the argument leading up to the conclusion stated by the Royal Commission as follows:—

> "We conclude therefore that the deficiency in the present size of the family below that required in the long run for replacement may be roughly computed as of the order of 6 per cent. There is certainly some deficiency" (para. 157).

Since we did not see the substance of Chapter 7 before the publication of the Report, it stands on the sole responsibility of the Royal Commission. Subsequently, however, the Chairman of the Royal Commission asked that we should indicate our views on the main conclusions of this Chapter. The central statement in the Royal Commission's argument, from which all the rest follows, is that an average size of family of about 2·2 children per married couple "for the time being seems to represent the family-building habits of the British people". On the basis of the information available, we think that this figure is probably not far from the truth; but we would lay much more stress than the Royal Commission has done (at least in Chapter 7) on the difficulty at this time of estimating the "present" size of family and on the considerable degree of uncertainty which must necessarily attach to any such estimate. As a result, in our view, the Royal Commission's statement that "there is certainly some deficiency" [in replacement] is too definite.

11. In order to provide the Royal Commission with material required for the statistical chapters of their Report we have supervised the preparation of a series of population projections, a report on which will be found later in this volume. We also print memoranda by the Government Actuary's Department on "*A Hypothetical Life Table for Great Britain*, 1942–44", and on "*The Course of Mortality in Great Britain*". Both of these were prepared to assist in the calculation of the projections.

12. In the course of our work on the trend of population, we have been led to examine certain matters related to the study thereof. One of these was the arrangements at present in force for the collection and tabulation of fertility statistics. The conclusions to which we were led by this examination were embodied in a report made to the Royal Commission on "*The Analysis of Fertility Statistics*". At our invitation the Registrar General for England and Wales gave us his views on certain proposals discussed in this report and in the light of his comments we prepared a further short report on the same subject. Both of our reports, and also the Registrar General's memorandum, are printed in this volume.

13. Secondly, we were led to examine the present organisation of the departments responsible for official work on the statistical analysis of population trends in this country. Our conclusions were embodied in a report to the Royal Commission which is included in the present volume.

14. We have now mentioned all the major pieces of work undertaken by the Committee. We have not thought it necessary to give a detailed account of all the matters on which we advised the Royal Commission.

15. In the course of our work we have received much assistance from government departments and from individuals. Our chief debt is to the General Register Office for England and Wales. Besides supplying the Committee with advance copies of the normal tabulations of births and other regular population data, the Office has furnished us with detailed estimates of populations by age, marital status, and duration of marriage. It has further made certain statistical tabulations specially for our purposes, including (1) a tabulation of the births, still-births and infant deaths occurring in 1939 by the occupation of the father, and (2) a tabulation by calendar year of marriage of the mother of a sample of the births of 1946. It has also provided us with a series of papers on various aspects of the trend of population containing much valuable material and many stimulating observations. We have been pleased to observe that some of the material so presented has already been published in the *Registrar General's Statistical Review* (Text Volume) for 1938–39. We trust that other parts of what has been put before us will also be made generally available in the same way in the near future. We must also mention the very thorough examination made by the General Register Office of the proposal for a family index which we had suggested for consideration in our report on the analysis of fertility statistics, referred to above (para. 12).

16. The General Registry Office for Scotland has been extremely helpful to us. It has supplied us with a great deal of statistical material necessary for the assembling of statistics relating to Great Britain[1]. It also gave invaluable assistance in the organisation and execution of the Family Census in Scotland.

17. The Government Actuary's Department has provided us with a series of valuable studies of particular problems. As is mentioned above, it calculated a standard population of married women by age and duration of marriage and employed it to compute "nuptial standardised" reproduction rates. It prepared, at our request, a valuable compilation of migration statistics; it undertook a special analysis, designed to throw light on the trend of family size, of the number of dependent children of women claiming widow's pensions

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(1) A compilation of demographic statistics relating to Great Britain is included among the papers printed below.

under the Contributory Insurance Acts. It provided us with a life table for Great Britain in 1942–44 which has been the basis of the work done for us on population projections, and it further assisted the same work by making a study of the trend of mortality rates and their possible course in the future.

18. Finally, through the good offices of the Institute of Actuaries, we received assistance from two of its members. We are particularly indebted to Mr. Wilfred Perks, who made a study of the marriage statistics of the 1931 census, and also gave us the benefit of a careful examination of the report by Dr. Notestein and others on the future population of Europe and the Soviet Union. Mr. N. E. Coe assisted our staff with a difficult statistical problem connected with the estimation of the distribution of families by size from current fertility rates. We wish to express our gratitude to these gentlemen and to the Institute under whose auspices their help was so generously given.

19. The Committee are much indebted to Mr. Hajnal, who acted as Research Assistant from October, 1944, to March, 1948; he conducted research with marked skill on a number of important topics, partly in co-operation with the Assistant Secretary and partly independently.

20. In conclusion, we wish to pay a very warm tribute to the services rendered by Mr. W. A. B. Hopkin, the Assistant Secretary to the Royal Commission, who has acted as secretary to our Committee. In addition to the performance of normal secretarial duties he prepared important memoranda and undertook extensive investigations into highly technical fields. His services were of the utmost value to us.

A. M. CARR-SAUNDERS (*Chairman*)
H. CAMPION
D. G. CHAMPERNOWNE
*V. P. A. DERRICK
D. V. GLASS
J. G. KYD
G. H. MADDEX
F. A. A. MENZLER
A. REEDER
*P. STOCKS

NIVEN F. McNICOLL, *Secretary*
W. A. B. HOPKIN, *Assistant Secretary*

8th February, 1950.

* Signed subject to the reservation referred to in para. 9 above.

Introductory Memorandum by the Statistics Committee

1. The papers included in the present volume represent, in the main, various stages in the attempt to define and measure the level and trend of fertility in Great Britain, and to ascertain the consequences of the trends of fertility and mortality inferred from available statistics as well as certain possible future movements in fertility and mortality. In considering these papers it is important to bear in mind the state of demographic statistics in Great Britain and the general concepts used in demographic analysis.

2. Demographic statistics for Great Britain have had a relatively long history. The first of the periodic censuses was taken in 1801 and civil registration of marriages, births and deaths began in 1837 in England and Wales and in 1855 in Scotland. From their beginnings, these census and vital statistics were very accurate and they have steadily improved. So far as reliability was concerned, they have no need to fear comparison with the statistics of any other country. But the scope of British birth registration statistics did not change materially for a hundred years. Not until the Population (Statistics) Act of 1938 was the age of the mother at the birth of a child asked for at the time of registration. Although the collection of this and other information was urged during the 19th century, especially by William Farr, concern with mortality had in general so overshadowed all other aspects of vital trends that there was little active interest in the fertility side of vital statistics until public attention was caught, in the 1930's, by the persistent decline of the birth rate and its apparent significance for the future growth of the population. The defect was remedied by the 1938 Act. Indeed, the Act went much further than simply providing for the age of the mother, by including among the information asked for at birth registration the duration of marriage and order of birth for legitimate children. At one move, the scope of the data was so extended that, for fertility analysis, British birth statistics are now among the best available. But these amplified statistics relate only to births since July 1938. Moreover, their usefulness at the time when we were appointed was restricted by the lack of equally comprehensive population statistics. There had been no full census since 1931. Still more important, the only fertility census which had so far been taken in Great Britain was that of 1911. Thus there were no up-to-date statistics of married women distinguished by duration of marriage and by number of previous live births, to act as denominator for the comprehensive new births statistics. To make extended use of those new statistics, it was necessary to construct estimates of the basic populations. Even so, much of the relevant analysis had to be restricted to women married since 1938.

3. Attention should also be drawn to the concepts currently applied in analysing the reproductivity of human populations. In the main, the development of modern concepts of reproductivity has been due to Kuczynsk and Lotka. It was Kuczynski who proposed, in 1907, the total fertility rate as a measure of "pure fertility", and who applied and brought to public notice the net reproduction rate, invented by Boeckh in 1884.(1) So well-known has the net reproduction rate become in recent years, that it has been widely regarded as an index of the demographic health of the country. On the other hand, the independent work of Lotka provided a far wider and more

(1) In Great Britain the concept of the Net Reproduction Rate was independently developed by the General Register Office for England and Wales and first published by them in the *Registrar General's Statistical Review* (Text Volume) for 1926.

rigorous system of analysis in which, regarded in terms of logical structure, the gross and net reproduction rates were only the preliminary steps. Beginning in 1907 with a study of the relation between birth and death rates, Lotka evolved a method of mathematical analysis which proved that, given the continuance of any given age-specific female fertility and mortality rates, a population would ultimately have a fixed (stable) age and sex composition, fixed birth and death rates, and, consequently, a fixed annual rate of natural increase. By this method, too, the ultimate or " true " annual rate of natural increase, as well as all the other derivatives, could be calculated for current populations by using appropriate age-specific rates for females and the relevant life tables. Both the net reproduction rate (R_o) and the true rate of natural increase (r) were used as measures of the extent to which, given the fertility and mortality of the chosen country and period, the population was tending to " replace " itself, and an R_o of 1·0 or an r of 0·0 was taken to mean that, if the specified fertility and mortality persisted (and excluding migration as a factor), the population would ultimately become stationary.

4. In essence, both R_o and r were calculated by relating the numbers of female children born in a given period to mothers of various ages, to the total populations of women of the same ages, and by allowing for mortality between birth and potential parenthood of the ensuing generation. Variants had been proposed and used by other demographers. In particular, different proposals for introducing marriage as a factor had been put forward by Wicksell in 1931 and by the German Statistical Office in 1935, but had not found general acceptance. Kuczynski had suggested splitting up the reproduction rate by birth order. Whelpton later proposed the construction of a reproduction rate based on " true " birth order. The General Register Office for England and Wales also introduced its own measure, the " effective " reproduction rate, substituting projected for current mortality. But, in general, these variants did not constitute any basic revision of the concept of a reproductive index. The most serious criticism was put forward independently in 1941 by Myers (1)([1]) and Quensel (2). The nature of this criticism, which raised the question of the validity of a reproduction rate based exclusively on females, will be considered later.

5. Whatever the validity of the customary reproduction rate, it cannot be regarded as more than a mechanical index of the position indicated by a given set of fertility and mortality rates. No actuary would regard the expectation of life at birth, calculated from current mortality rates, as indicating the probable future trend of mortality. Similarly, the reproduction rate as such gives no estimate of the probability that the particular fertility and mortality rates would be likely to persist. However studied, there was no doubt as to the marked fall in fertility since the 1870's. Looked at in terms of the customary indices, however, the fall had reached its lowest point in the mid 1930's and fertility had subsequently risen, especially during the later years of the war. In terms of the net reproduction rate, the low point was reached in 1933 with a rate of about 0·74 for England and Wales. The rate then rose slightly but fell back at the beginning of the war and in 1941 it was again only 0·74. Thereafter it rose sharply and by 1944 it was already 0·98. The rate for Scotland showed a somewhat similar upward trend. What did this movement mean? Was there a genuine increase in fertility for the first time since the 1870's, or was the upward trend merely a feature of the particular statistical indices employed? Further, were the rates for, say 1933 and 1944, truly indicative of the extent to which, at those points of time, the population was replacing itself?

([1]) The figures in parentheses refer to studies the full references to which are given in the appendix to this introduction.

6. On the first question, it was clear that an answer could not be obtained except by studying in detail the course of marital fertility. Such a study meant using the extended tabulations of data collected under the Population (Statistics) Act, and a paper included in this volume shows the kind of analysis undertaken(1). But the calculations involved were not entirely satisfactory. They were based on estimates, subject to a varying degree of error, of the numbers of women at successive durations of marriage. The story they told covered a brief span of years, and almost all of them war years. Further, they gave no indication of fertility trends of the different social classes in the community. Some information on this last question was provided by a special tabulation, carried out by the General Register Office of England and Wales at the request of the Committee, of the 1939 births by the occupations of the fathers.(2) But the results necessarily related only to fertile marriages and could do no more than seemingly confirm the continued existence of fertility differences. They could give no indication of any trend in these differences, though knowledge of such a trend is of great importance in considering future population growth. For all these reasons it was felt by the Statistics Committee, and agreed by the Royal Commission, that additional data were needed and that these data could best be obtained by taking a new fertility census.

7. The Family Census, as this new fertility census was called, was taken for the Commission on a sample basis by an *ad hoc* organisation. The ultimate sample consisted of 10 per cent. of all the women in Great Britain who, in January 1946, were or had been married. It was not possible to use the compulsory powers normally attached to the census and the success of the Family Census therefore depended upon the voluntary co-operation of the women in the sample. In all, at least 87 per cent. of the women in the sample actually completed schedules. The actual extent of co-operation was even higher than is suggested by this figure, for about four-tenths of the missing women consisted not of those who would not respond but of women who could not be located by the enumerators.

8. The full results of the Family Census will be published in separate reports. Provisional data have, however, been used by the Royal Commission in studying trends of fertility over the past generation and in evaluating the significance of recent movements in births, and the results are embodied in the report of the Commission. It is therefore appropriate to include in the present collection of papers a preliminary report on the Census, and this has been done.(3) At this point we may briefly refer to some of the general results and indicate their bearing upon the questions examined by the Statistics Committee. The figures given in the preliminary report show the marked stability of total family size of the recent cohorts of marriages; in particular they show that in spite of the rise in the number of births during the latter part of the war, family size had not increased by the end of 1945. The large further rise in births after 1945 is discussed in Appendix 3 to the preliminary report, in which the birth registration statistics of 1946–48 have been "spliced on" to the Family Census results in order to show the position as at the end of 1948.

9. The provision of new information by means of the Family Census was a fundamental part of the detailed examination of fertility trends in Great Britain. But whatever the results of the Census, the new data had to be

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(1) See Hajnal, (3).
(2) See Hopkin and Hajnal, (4).
(3) See Glass and Grebenik, (5).

interpreted not merely as indices of the trend of marital fertility, but in specific relation to the question of reproductivity and its measurement. Various problems are involved and they will be considered briefly here and approximately in the order in which they came to be discussed.

10. Attention was drawn to the effect on the customary reproduction rates of changes in marriage, and especially of the changes which had taken place in Britain since 1938. That the reproduction rate will rise if, other things being equal, a larger proportion of people marry, is of course clear. But if there is, say, a series of sharp increases in marriage frequency, the crude reproduction rate may give a false impression of changes in the total reproductivity of the population.(1) Two points should be noted in this connection.

11. First, a sudden increase in marriage frequency for a few years will markedly raise the proportions of *recently married* couples in the total married population. Now it is during the first ten years of marriage that births are most likely to occur. Thus, even if there is no change in the total size of families borne by married women, age-specific marital fertility rates will rise when there has been an increase in marriage frequency. At the same time, the increase in the proportion of recently married couples will be abnormal in the sense that it cannot be maintained indefinitely. The crude reproduction rate, which will tend to rise sharply, will not be indicating the real trend in total reproductivity. Calculations by the Government Actuary's Department, which are included in this volume, show, for example, a marriage-standardised gross reproduction rate for England and Wales (standardised on 1938 marriage rates) only 92 per cent. as high in 1942 as in 1938, whereas the crude rate for 1942 was 4 per cent. higher than that for 1938.(2)

12. At the same time, an increase in marriage frequency is often accompanied by a fall in the age at marriage. This has been the case in Britain in recent years. The proportions married at the younger ages have risen much more sharply than those at the older ages. What effect on crude reproduction rates is likely to follow a change in the age at marriage? It is possible to imagine a case in which there is no increase in the proportion of persons who marry before the end of the reproductive period, but a sudden decision on the part of men and women generally to marry younger. What would happen then? It might be that the couples who marry earlier would have larger total families, either because of the influence of earlier marriage on their attitude to family size, or simply because there is a longer period of exposure to risk of pregnancy, during which period more "accidents" may occur. But even if there were no increase in family size, the fall in the age at marriage would bring into the ranks of potential parents new generations that otherwise would not have appeared there until later, and there would in consequence be a rise in the annual numbers of births even if the reduction in age at marriage did not affect the total fertility of marriage. Some increase in births would be evident until the new generations brought in had passed through the child-bearing years. The total reproductivity of a generation would not have increased, and the ultimate annual rate of decline (reached only after an extremely long period) of the population would actually be steeper if reproductivity were inadequate, for the generation would be shorter. But the customary reproduction rate would rise and be abnormally high so long as there were "speeded-up" births occurring as a result of the lower age at marriage. That some development of this kind has taken place in recent

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(1) See also Pollard, (6).
(2) See Government Actuary's Department, (7).

years is shown by Hajnal, who also demonstrates that the " excess " marriages resulting from a fall in age at marriage are equal to the marriages which would otherwise have taken place in the number of years by which the average age at marriage is reduced. The reverse movement would occur if there were a rise in the age at marriage.[1]

13. The importance of taking marriage into account in constructing an index of reproductivity may be seen in another connection. The customary reproduction rate is calculated by relating female births to women of child-bearing age. It would be no less valid to relate male births to potential fathers, and this had been done in the past by, for example, Lotka and Kuczynski, both of whom had seen that male and female rates gave different values. Later, both Myers and Quensel studied the differences between such rates. The importance of these differences was, however, first fully considered in the studies of Hajnal (9) and Vincent (10), and in an exhaustive examination by Karmel (11, 12, 13 and 14).

14. It is not to be expected that the male and female reproduction rates would be equal for a given population. Even in a stable population, equal male and female rates would require either a reproduction rate of 1·0 or the same ages at marriage for males and females. But since the " true " rate of natural increase allows for differences in the length of a generation, there should be the same " true " rate for males and females, for, excluding migration, two different rates cannot apply simultaneously in the stable population. In actual populations, however, the " true " rate yielded by the customary methods of calculation are not the same. For England and Wales, 1938, for example, the approximate male " true " rate was —0·004, while the female rate was —0·007, implying a very much steeper ultimate decline of population. The two rates differ because of the abnormal sex structure of the existing population. More specifically, post-war mortality and overseas migration have produced an excess of females over males in the marriageable and childbearing ages, so that the proportions married for women are low relative to those for men, and the female and male age-specific fertility rates are correspondingly different. But in a stationary population corresponding to the mortality and masculinity at birth of, say, 1938, there would be no excess of females up to about 50 years of age, and the same would be true even of a stable population corresponding to the fertility, mortality and sex ratio at birth of 1938. Such a change in the sex ratio of the population would be accompanied by some change in the proportions married among either men or women or both, and this would in turn effect the overall age-specific fertility rates. Thus, to calculate consistent generation reproduction rates or " true " annual rates which are consistent for males and females, it is necessary to define fertility in such a way that it is capable of persisting as the population changes from the actual to the stable state and as the sex ratio and the proportions married also change. This can only be done if both nuptiality and marital fertility are specified. Even then there is no rigorous solution because, in the present state of knowledge, it is not possible to say precisely how nuptiality will change as the sex and age structure alter. Approximations are, however, possible, and both Hajnal and Karmel have made suggestions to that effect. Karmel's suggestion (14) is a mean of the nuptially-controlled male and female " true " rates, while Hajnal (8) proposes a single rate based on a mean of male and female nuptiality, applied to an estimate of the total number of births per marriage by age at and duration of marriage.

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(1) See Hajnal, (8), Section D.

15. The previous discussion has dealt with a number of specific problems elating to the measurement of reproductivity. Generalising the discussion, he following main points may be made:

(1) In the past, wide use has been made of the customary net reproduction rate (and this applies to the crude " true " rate of natural increase) both because it appeared to be an explicit measure of reproductivity and because, as such, it seemed to eliminate the effect of temporary aspects of population structure. In fact, however, the customary reproduction rate eliminates only the effect of current age structure. But in all actual populations, the sex ratio is also transitory and to base a reproduction rate on that sex ratio means giving an incorrect assessment of the level of reproductivity. In other words, looked at simply as an index designed to express the resultant, for future population growth, of current vital forces, the net reproduction rate is not appropriate because it assumes a persistence of conditions which, by their very nature, must change.

(2) This does not impair the concept of reproductivity as such. But it means that an index of reproductivity should define fertility rates in such a way that these rates can persist as the population changes from its actual to a stable state. To do this involves two stages—calculating a nuptiality table which is compatible both with current marriage rates and with the change in the structure of the population as it becomes stable; and calculating marital fertility. Allowance must also be made for illegitimacy, but in most Western countries that is a minor factor.

(3) Marriage and fertility rates acceptable on the above terms may nevertheless not be realistic expressions of the vital forces characterising a community. For example, a nuptiality table constructed in a period of sharply rising marriage rates might imply remarkably high ultimate proportions married among persons aged 45–49 years. In the past, however, as shown by census results (see Hajnal (9)), such proportions have been extremely stable. Are they likely to rise in the way suggested by the nuptiality table?

(4) Similar questions arise in attempting to construct fertility rates. For example, in one of the new reproduction rates calculated by Hajnal in the comprehensive report published in this volume (Hajnal (8), Note III), the marital fertility rates used are based on maternities by age at and duration of marriage.[1] These rates are derived from the experience of a particular year, e.g. 1944, the gross fertility of a woman marrying between her 20th and 25th birthdays being obtained by summing the maternity rates of women who, having married at such ages, reached various durations of marriage in 1944. A woman marrying between ages 20 and 25 and passing through the duration 0–4 years would, in 1944 experience, have 1·07 maternities in that duration. A similar woman passing through the 5–9 years duration according to 1944 experience would, in that duration, have 0·71 maternities. The gross fertility of a marriage lasting 10 years would thus be 1·07 + 0·71. But to proceed in this way assumes the independence of fertility at various durations of marriage—assumes, in other words, that the number of children born to a woman between the 5th and 10th year of marriage is unaffected by the number born in the previous 5 years. This is not likely to be true, as Hajnal himself pointed out. In fact both age-specific and duration-specific fertility rates would show violent fluctuations from year to year if, without any change in the total number of children borne by each woman, there were a change in the way the births of those children were spread over

(1) The report was written before the results of the Family Census were available.

married life(1). If, say, for economic reasons or because of war, women postponed having a second child from the fourth to the eighth year of marriage, there would inevitably be a substantial fall in the rate for the fourth year of marriage and subsequently a large increase in the rate for the eighth year. Estimates of family size derived from the duration-specific rates observed in either of the corresponding calendar years would be unreal. The real family size would be found only by ascertaining the total numbers of children born to women during their married life. But to do this, by tracing the reproductive history of one or more marriage cohorts, means either to base one's results in large degree on past events or, by concentrating on the most recent cohort, to have an incomplete picture of fertility.

(5) Much more work needs to be done in this field of demographic analysis. At the moment, however, it is extremely difficult to think of a method which, while being acceptable theoretically, can also be said to give a completely realistic index of the fertility habits of a particular year or other short period, unless those habits have become stable. If they have become stable, the results obtained by splicing together the duration specific rates observed in a particular year would give the same picture as that seen by tracing the fertility experience of a recent marriage cohort. But even if fertility appears to have been stable for several years, it cannot be assumed that such stability will be a permanent feature, and it was certainly not so in the past. In that event, to estimate the total number of children born per marriage, as implied by current fertility habits, is very much a matter of speculation. In practice, it may be no easier to establish what family size would result from current habits than to discern what is likely to be the family size which will obtain in the near future.

(6) It follows from the previous paragraphs that the search for an automatically calculated index of reproductivity, theoretically valid and realistically describing the vital forces of a given year or other short period, is not likely to be successful. The most one can hope to do is, as Hajnal has shown, in his study of reproductivity, to specify a range within which the index will probably lie. Even so, it should be remembered that a whole series of indices is possible, and that they would not all give the same results. Thus an index based on marital fertility may relate to particular marriage cohorts. The generation or generations involved would not be the same as those covered by an index which, like the customary net reproduction rate, purported to look at the ultimate issue to a cohort of births taking place in a given year. There is, in fact, no unique index of reproductivity.

16. The above discussion, and the report by Hajnal(8) included in this volume, suggest that the technical demographic analysis of replacement is both more complex and more speculative than is usually envisaged. This has an important bearing upon population projections, with which the Statistics Committee was also concerned. It is not here a question of the speculation involved in estimating what course fertility is likely to take in future. Many other factors would naturally be involved in answering such a question—the influence of economic and social factors on marriage and on the attitudes of married couples to family size, the spread of birth control and its effectiveness,

(1) See Hajnal, (15). The postponement and making-up sequence also explains in large measure developments in England and Wales after 1938.

and so forth. The speculative element referred to here is that involved in defining current marriage and fertility habits as a basis for ascertaining what would happen over, say, the next fifty years, if these habits were to persist.

17. The Statistics Committee regarded it as part of its task to sponsor a set of projections of the population of Great Britain. Summary results of such projections have been published in the report of the Royal Commission. A more detailed presentation is contained in the present volume, accompanied by an account of the techniques used in carrying out the projections, and it is thus not necessary, in this introduction, to deal at any length with them. It should be pointed out, however, that the approach was conditioned very markedly by considerations of the kind already discussed, and is thus different from that usually followed. Most population projections arrive at future births by applying age-specific fertility rates to total women in the separate childbearing age-groups. In the new projections, however, estimating future births was a two-stage process. First, marriages were projected. Secondly, births were derived by applying duration-specific legitimate fertility rates to the marriages. A particular cohort of marriages would thus be found to yield x births in the first quinquennium of married life, y in the second quinquennium, and so on. The total number of births occurring in any particular quinquennium is thus the sum of the births contributed in the period by all the cohorts of marriage still potentially able to bear children in that period. It will also be seen that, in specifying current marriage habits, a range has been chosen, namely the male marriage rates in 1942–47 as the higher point, and the female marriage rates as the lower point. The possibility of changes in the age at marriage was allowed for in other sets of assumptions. No attempt has been made to predict future family size. Analysis of vital statistics and Family Census data suggested that current marital fertility might yield a family size about 5 per cent. higher than that yielded by pre-war rates. This provided one basis. Another basis taken was pre-war fertility rates (1935–38), and a third assumed fertility about 6 per cent. higher than the first. The latter assumption means, taking marriage as half-way between the results produced by the male and female marriage rates of 1942–47, and allowing mortality to decline until 1978, an ultimately stationary population. Other fertility postulates have also been selected to extend the range of the projections.

18. On mortality, a special study was undertaken by the Government Actuary's Department (16). The basis of current mortality was a new life table for Great Britain for 1942–44, prepared by the Government Actuary and included in the present volume (17). For projecting mortality, past death rates in England and Wales were studied and curves of various types fitted to them. On general grounds it appeared most appropriate to use exponential curves to project mortality into the future. On this basis, and allowing for the relation between mortality in England and Wales and Scotland, the expectation of life at birth in Great Britain would increase, between 1942–44 and 1978, from 62·7 to 69·0 years for males, and from 67·4 to 74·0 years for females. The generation approach was also used—that is, assuming that a generation carries with it in some way its own mortality. Unadjusted calculations made in this way envisaged a still larger increase in the expectation of life by 1978—to 71·5 years for males and 76·2 years for females—the fall in mortality being especially marked at the older ages. There were, however, some difficulties in accepting the generation approach. Different methods of application gave significantly different results. Further, mortality at ages above 55 years fell sharply after 1941, and this was probably at least partly due to the introduction of the new chemotherapy. In the exponential approach the experience of this recent period would not have as marked an effect on the projections as in the

generation approach. On balance, it was decided to use only two sets of mortality assumptions—one based on the mortality of 1942–44, and the other based on the exponential approach and postulating a fall until 1978, mortality thereafter remaining constant. It may well be, however, that mortality rates at the older ages will fall much more steeply than is allowed for in the projection.

19. Finally, it was agreed that assumptions regarding the trend of overseas migration should also be provided. It should be emphasised, however, that the assumptions made are entirely by way of illustration and do not in any real way derive either from historical developments or from any study of migration prospects. Some use has been made of historical material in estimating the age and sex distribution of migrants but it is probable, in view of contemporary migration policies in the Commonwealth, that migrants will ot have the same age and sex structure in the future as in the past. One of ie difficulties in making realistic assumptions concerning migration is the xtremely poor quality of past and present migration statistics and, in addition, ie lack of comprehensive studies, even within the limits of the available atistics, of the migration history of Great Britain. This is another field in hich far more work needs to be done.

20. During the course of its discussions the Statistics Committee was onstantly faced with the lack of adequate statistics in the field of demography. t has already been pointed out that, as a result of the Population (Statistics) ct, British vital statistics are now among the best available. But as has also een emphasised, the use that could be made of these statistics was limited oth by the short period for which they are available, and by the absence of imilarly comprehensive basic population statistics. Because of this situation was natural that the Committee should pay attention to the provision of emographic statistics and to the official organisation responsible for collecting nd analysing them. Several memoranda on this subject were prepared, nd the chief documents are included in this volume(1). Since the documents re, in the main, self-explanatory, only a brief comment on them will be made ere.

21. Experience of analysing fertility trends in a period of violent fluctuations n marriages and births, made it clear that a more comprehensive approach vas desirable, the kind of approach followed in Hajnal's analysis of births n England and Wales, 1938–43, and in the tabulations of the Family Census. nstead of examining variations in birth or fertility rates from year to year, t is necessary to trace the reproductive performance of specific groups of women t the various stages of their marital history. In this way it would be possible o see movements in average family size for each group of women at various lurations of marriage as well as changes in the distribution of family size. n other words, the basic concept in demographic analysis would be the iological family, defined for this purpose as the number of live births occurring o a married woman during her reproductive period. This concept has the dvantage of transcending those short-term fluctuations in fertility rates which lo not affect ultimate family size; it also has great advantages when considering uch influences on future trends as economic and social factors and the revalence of birth control, for in the long run it is the total family size which s really the basic question involved.

22. To obtain statistics adequate for this purpose means linking together various sets of vital events—relating the births occurring in various years to he particular group of married women to whom they occur. This can already

(1) See references 18, 19, 20 and 21.

be done to some extent—and, in fact, has been done—from existing vital statistics. But those statistics are not as yet fully satisfactory. Indeed it would be surprising if they were, for they have developed, as in all countries, in somewhat piecemeal fashion. It has rarely been possible for the demographer to ensure that the statistics most suitable for answering his specific questions are collected. On the contrary, he has usually to determine how he can best answer his questions from what statistics are available. If, however, population trends are a matter of concern to the community, and they surely must be, then it is appropriate to consider what kind of statistical system will most facilitate the study of such trends.

23. Two methods are available to provide the kind of data required. First, if there were a continuous registration system in which a card was established for each marriage, and on this card were entered details concerning the husband and wife, the marriage, and any birth or death subsequently occurring, such a system would produce statistics of outstanding value for demographic analysis. Family censuses could be taken by sampling the cards, and detailed studies of family size could be carried out. The problems of harmonising vital and census statistics would not arise, since the cards would give the population at risk, as well as the births occurring to that population. But to organise a system of continuous registration would involve many administrative difficulties, and unless there were a stringent statistical control of movements into and out of the country, the system would rapidly become ineffective. Moreover, family censuses—perhaps of a somewhat different kind—would be necessary to test the accuracy of the system. The second method, not giving rise to such problems, would consist of taking periodic family censuses to provide the basic population statistics (as well as to supply historical data and perhaps also social class analysis of a kind otherwise far more difficult to carry out), and modifying to some extent the questions asked at birth and death registration and the tabulations of vital statistics. Since, in view of the importance of population trends, there is every reason to hope that family censuses will be taken at regular intervals, there should be no serious difficulties in applying the second method.

24. It is also important that, while the statistics continue to be collected separately for England and Wales and for Scotland, at least the most relevant statistics should also be provided for Great Britain as a unit. For many purposes Great Britain is a much more satisfactory base for analysis. In particular, migration across the border, otherwise difficult to take into account, would then offer no problem. But to supply statistics for Great Britain requires more than adding together the data for the constituent countries. It will be necessary to ensure that the questions asked at registration and in censuses are asked in the same way in each country, and that the same tabulations are used, at least for the categories relevant for the study of population trends.

25. As regards the analysis of fertility statistics there is no doubt that the General Register Offices, which collect the basic material, should be best fitted to undertake the work. But they have not been adequately staffed for this purpose. The Statistics Committee considered the organisation of the General Register Offices and a memorandum on that subject is included in this report. In particular the Committee urges the establishment in the General Register Offices of adequate statistical divisions, staffed with competent statisticians and given responsibility for all tabulations and statistical analysis and consulted in all decisions affecting the collection of data. Only in this way can it be ensured that full attention will be given to the statistical study of population trends in Great Britain. Without such constant study, demographic research is not likely to be fruitful.

26. Demographic research of the kind envisaged will, it must be realised, entail an elaborate and costly system of notification, recording and analysis, and it may be objected that this is too high a price to pay for research. But quite apart from the significance of demographic research as such—and without it, no progress in population analysis is possible—it is important to emphasise that the discussion in this report and, indeed, in all the work of the Statistics Committee, has not been concerned simply with academic questions. The problem has been research not for its own sake, but with the object of giving the community a more comprehensive and realistic view of the trend of population in Great Britain. Having regard to the economic, social and political implications of the trend of population, it can scarcely be denied that such demographic research is of the greatest practical relevance.

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FERTILITY MEASUREMENT AND THE REPRODUCTION RATE

ADDENDUM TO THE FOREGOING MEMORANDUM BY MR. V. P. A. DERRICK AND DR. P. STOCKS

In paragraph 9 of the Committee's report attention is drawn to divergences of views between members of the Committee concerning the measurement of reproductivity. In these circumstances, we have deemed it desirable to append the attached observations, partly to call attention to certain aspects wherewith we differ from the majority statement, but in the main to supplement it with additional matter which we feel ought to be included in any balanced purview of the situation.

The need is reinforced by the fact that we are officers of the General Register Office, the Department which is called upon to examine and report upon the vital statistics of each year as the experiences steadily unfold. In such circumstances, choice in the matter of measurement technique must be influenced by the need for methods as direct and free from personal judgment as possible, so as to ensure maximum comparability between the experiences of different years or of different populations and capable also of being readily understood by the wide section of intelligent lay public to whom the reports are primarily directed.

The main subject of controversy concerning fertility measurement has been the part to be played by the function which has come to be known as the reproduction rate, and which, in the observations now being made, must be deemed to refer to the particular brand of the function used by the General Register Office and described for purpose of distinction as the Effective Reproduction Rate (ERR).

The Committee majority refer to the ERR in their Introduction, and in a generic treatment with other alternative constructions express the views (par. 4)

(*a*) that it was a variant which did not constitute any basic revision of the concept of a reproduction index;

and in the following paragraph 5

(*b*) that, whatever its validity, it cannot be regarded as more than a mechanical index of the position indicated by a given set of fertility and mortality rates.

Both these statements are misleading.

In the first place, the General Register Office construction was not a ' variant '; it was an original in the sense that it was a completely independent construction. When it was first referred to in the Registrar General's Statistical Review for 1926, there was no generally understood concept of a reproduction index in existence, nor indeed was there any widespread interest in the subject. That isolated work in the field had been undertaken in other countries is not surprising; but the General Register Office was not aware of it and, so far as is known, this 1926 presentation was the first to introduce the type of measurement in the statistics of this country. It was not till later that Kuczynski's much publicised ' net reproduction rate ' came to notice.

It is not suggested that the 1926 innovation reflected any particular perspicacity on the part of the constructor. He was faced with an immediate problem—viz. that of explaining the inwardness of what seemed to be a dangerous fall in the birth rate—and his improvised sufficiency test was such as would naturally occur to a Department familiar with life table technique.

But it had the virtue of an original in that it was conceived simply and solely as a replacement index, i.e. as an objective measurement of the degree of replacement involved in a given birth experience, and that, as such, it was not hampered by artificial constraints associated with any rigid mathematical or hypothetical technique. It was free to be modified in the direction of improving its intended measurement function and modifications to this end have been and are continuing to be made.

In so far as the index possesses the desirable quality of being independent of personal bias it may perhaps be fittingly described as a mechanical one, but it is incorrect to imply that it depends on a given set of fertility and mortality rates. It can be shown that the part played by fertility rates in the construction of the index is quite a secondary one and they could be omitted altogether without serious loss; while the mortality contribution is solely that involved in obtaining the best objective estimate of the proportion of infants likely to survive to their reproductive ages, and is not the subject of an arbitrary determination as in the 'net reproduction rate.'

But while the basic concept on which the ERR was founded was a sound one, there is no doubt that difficulties have been experienced by both constructors and users alike in attempting to describe or understand precisely what the ERR is or what it purports to measure. It has been variously regarded as a measure of the replacement, as between successive generations, either of women, or of children, or even of potential parents, vaguely implying the existence of some common reproduction attribute inherent in each of these alternative relationships but without making it clear what this common factor is or why it is correctly expressed by the arithmetical construction employed in its evaluation. A similar sort of vagueness attaches to the meaning of the 'population' which the standard ERR is conceived to maintain; since the maintenance of numbers at ages beyond the childbearing range involves considerations that are not taken account of in the ERR construction.

Consideration is being given to the clarification of these ambiguities and it is hoped that it will be possible to include a statement on the subject in the Registrar General's forthcoming Statistical Review for the years 1940–1945 (Birth Section). Fundamentally the ERR is a measure of equivalence between a mass of potential mothers on the one hand and the mass of their infant progeny produced in a given period on the other, and its examination raises the question as to what precisely is the common fertility attribute possessed by each of these very different conglomerations of individuals which is capable of being measured and compared. The logical answer is hardly in doubt, since the only attribute that they both possess is their fecundity or reproductive capacity; of which a certain amount is expended by the progenitor class in the course of producing the progeny and is replaced in a latent form by the greater or lesser capacity in the progeny created. It can be shown that the ERR does in fact represent the ratio of the capacity produced to the capacity consumed to a degree of accuracy sufficient for practical purposes, and it leads to the general conclusion that the ERR will be best understood as one feature in a system of measurements in which a population is measured, not by a count of the individuals within it, but in terms of its inherent reproductive capacity.

In the course of a population through time, its total reservoir of reproductive capacity is being continuously depleted as its members pass through and beyond the reproductive ages, and at the same time it is being continuously replenished by the latent capacity created in the newly born children; the level of the total reservoir thus going up or down as the added capacity of the children is greater or less than that consumed in the course of their production. If the capacity

created is of the same magnitude as the capacity consumed, the total capacity of the population necessarily remains unchanged, and thus the standard ERR of unity, instead of being defined in relation to a hypothetical future population is seen simply as the rate necessary to maintain the reproductive capacity of the population at its existing level. The type of population stability to be associated with such standard is not constancy in total numbers at all ages, but constancy in its primary creative factor in the form of its reproductive capacity. The maintenance of the capacity at a constant level would in practice tend to keep the non-reproductive elements within recognisable bounds though their precise numbers would not remain fixed since they would depend on mortality which would vary from time to time independently of the maintenance or otherwise of the primary creative factor.

The point to be observed in the present issue is that the ERR is a more or less precise measurement of a concrete fact and a highly significant fact in the proper understanding of the numerical evolution of a population. It ranks at a level comparable with more familiar indexes like birth and death rates and must, in our view, be bound to be recognised and maintained as such by the Department responsible for the routine record and presentation of the national vital statistics as the experiences steadily emerge.

The index possesses the virtue of being comprehensive in that it sums up, in a collective form, the effect of all the complex factors, ponderable and imponderable, which may have contributed to determine the number of births in the experience to which it relates, and as such it operates as a salutary control in any endeavour to isolate and assess the several contributory components separately.

In embracing all the contributory factors it necessarily includes those of a temporary influence as well as those of an enduring character and the Committee majority appear to regard the presence of temporary factors as a serious obstacle to its acceptance and use. But for more than one reason, their criticism on this ground is largely devoid of substance.

In the first place, during the more normal conditions of a settled peace time evolution, the effect of purely temporary factors is exceedingly small and is rarely enough to impart more than superficial ripples to the more fundamental trend curve.

In the second place, much of the distortion produced by temporary factors is capable of measurement, and where this is the case, it is removable and need in no way prejudice the inferences to be drawn from the measurement. Particularly is this the case in respect of the effect produced by changes in marriage rates and marriage ages which is referred to at some length in the majority statement. Such changes have both a temporary and an enduring effect on subsequent fertility and it is necessary to distinguish between the two since it is only the temporary element that could be regarded with disquiet. Women once married remain married for some time and any marked change in the numbers marrying or in their age incidence from time to time persists as a continuing fertility influence for the remainder of their married reproductive life. The more temporary effect due to the fact that their fertility is at a maximum immediately after marriage may possibly be regarded as a distortion but it is one to be resolved by measurement and not to be judged in terms of fancies conjured up by extreme hypothetical illustrations. As indicated above, its measurement shows that it is of no great substance under peace conditions, rarely affecting the ERR to an extent of 1 per cent.; while in 1941, which marked the culmination of the most phenomenal rise ever recorded for marriages in this country, it is doubtful whether it reached as much as 4 per cent.

On exceptional occasions of intense national disturbance such as the war and post war years through which we are now passing, imponderable factors may well be introduced which are not susceptible of immediate measurement and are sufficient to mask for the time being the operation of the more enduring factors—the considerable postponement of births from the war to the post war period is an example. In respect of such factors, shortcomings in the ERR are neither more nor less than those pertaining to any other system of measurement and all that can be done in such circumstances is to reserve judgement until the emergency is sufficiently passed to enable the period as a whole to be seen in a reasonable perspective.

The apparent concern of the majority of the Committee with the long term significance of the reproduction rates of individual war years in para. 5 of their memorandum is unconvincing. There was none. Even in a more ordered peace time, the rate for a single year is not of significance in itself, of the total reproductive capacity of a population, little more than 3 per cent. is consumed in any single year and the fact that it is replaced by a slightly different amount in the new births of the year is of little consequence to the total capacity. The apprehension concerning the insufficiency of births prior to the war arose not on account of a single year but from a continuing deficiency accumulating over decades, a deficiency which can be shown to have reduced the population producing potential of the nation by nearly 10 per cent. between the two wars.

It is difficult to understand how it has ever come to be thought that the reproduction rate purports to look at the future issue to the cohort of births of a given year, as is suggested in the penultimate sentence of para. 15 (6) of the introduction; or indeed how any specific measure of an experienced event could be regarded as claiming any predictive value. It is true of course that if a general trend in the reproduction rate over a series of years can be discerned, it will not be unreasonable, in the absence of contrary indications, to assume that the trend will tend to be maintained for some time in the future; but this arises from the fundamental nature of the reproductive force which the rate measures, and which, like any other natural force, must be regarded as possessing the attributes of momentum and inertia rendering sudden or violent change in its enduring features highly unlikely. At the same time, an inference of continuing stability in such circumstances would not be justified for more than a few immediate years; it could never be extended to cover the length of a generation, far less could it have any bearing on the long term future.

In thus claiming for the ERR a real and important status as a fertility measure, we do not of course question the need for examination and research into the behaviour of the separate individual factors which contribute in their various ways to total fertility.

The Organisation of Official Work on Population Statistics

REPORT TO THE ROYAL COMMISSION BY THE STATISTICS COMMITTEE[1]

1. It is the basic assumption of this note that the trend of population must henceforth be recognised as a matter of first-rate national importance, requiring constant surveillance by the government on behalf of the community. If this view is accepted, official interest in the study of population trends must become much keener in future than it has generally been in the past. It is thus pertinent to review the existing arrangements for the official analysis of population statistics and to consider in what way they seem to require further development to meet the requirements of the future.

2. It further happens to be the case that recent movements of population have stimulated the development of new and more complicated techniques of statistical analysis. These techniques are by no means easy to employ; they are far from having been reduced to a routine, and great care and intelligence are required if they are to be successfully applied. Moreover they are still developing and must be expected to continue to do so. In another report we have given a general account of the kind of analysis we think will be necessary in future, and have recommended certain changes in existing procedures for collecting and tabulating statistics so as to facilitate such analysis. But we would emphasise that it is not the case that either we or any other body could at this moment lay down a complete scheme of statistical analysis of population trends which could be relied upon to remain valid and adequate for many years ahead.

3. These considerations have an important bearing on the kind of staff and organisation that will be required in future for official demographic analysis. The expert staff employed on this work should not only be sufficient in numbers, but it must be of high quality. Moreover—and this is relevant also to the prospects of *attracting* to the work men of sufficient quality—suitable conditions of work must be ensured; the working statisticians need to have the status, the freedom and the facilities necessary to enable and encourage them to give of their best.

4. At present the only government departments engaged in regular demographic analysis on a considerable scale are the two General Register Offices, though the Government Actuary's Department, in the course of its work, is also concerned with many aspects of the trend of population and has made important contributions to their study.

5. The primary functions of the General Register Offices in their early years were the provision of records of civil status and the collection (through the Census) of population statistics for directly administrative purposes; demographic analysis was incidental and subsidiary. The effects of this historical development still persist although circumstances have greatly changed. The administrative work of the General Register Offices is of great importance;

(1) Two members of the Committee, Dr. Stocks and Mr. Derrick, are members of the General Register Office for England and Wales. As such, they felt themselves precluded from taking responsibility for a note which discusses the organisation of that Department.

if it were badly performed, the public would suffer serious inconvenience and the basic material of our population statistics would be impaired. The essential fact, however, is that the technique of administration in this field has been so thoroughly mastered that there is not the slightest danger in this country of breakdown or inadequate performance. Meanwhile the work of performing a comprehensive analysis and interpretation of the statistical material collected by the General Register Offices has become one of their major functions; but the prevailing attitude in official circles towards statistics and statistical research—an influence largely outside the control of the Registrars General—did not encourage the full development of the organisation of the departments in this direction. Unlike the administration of civil registration and census taking, therefore, the successful performance of the statistical work of the General Register Offices cannot be taken for granted. In these circumstances it appears to us that it is the statistical work of the departments which merits the most public attention and requires the most care and support from the authorities.

6. If in future the official output of statistical analysis of the movement of population was on no greater a scale than that which has been produced by the General Register Offices in the past, it could not possibly be adequate to the needs to which we have referred in our first paragraph. This does not imply any criticism of the past administration of the Register Offices, since the needs we are interested in meeting are only now being recognised. It is, in fact, our view that—given the importance we attach to the statistical work—the General Register Offices have been unduly starved of men and money for demographic study in the past, even in relation to the needs of former times; but we do not wish to stress this point. Our purpose is rather to make constructive proposals for the future.

7. We believe that the arrangements for the analysis of population statistics could be very considerably improved by measures internal to the General Register Office (by which in this and succeeding paragraphs, except paragraph 15, we mean the General Register Office for England and Wales). Of these the most obvious would be to add to the number of statisticians employed, and we are glad to know that additions have recently been made. Another and less obvious but possibly even more important step would be to reconsider the organisation of the General Register Office with the changed importance of its statistical work in mind. At present the General Register Office is organised in several divisions, and one of these is called the Statistical Division. The other divisions carry out duties which from the present point of view may be divided into two categories, (1) those which have no essential connection with the preparation of population statistics, and (2) those which are inseparable from the collection of population statistics. The latter category includes (*a*) some work (e.g. the supervision of the collection of information and making of returns by the local registrars) which is necessary to the production of population statistics, and (*b*) some other work (e.g. the central supervision of the arrangements for providing certificates of births, deaths and marriages) which although not a means to statistical ends could hardly be separated from (*a*).

8. We have been supplied, at our request, with an organisation chart of the present Statistical Division of the General Register Office for England and Wales. Such a chart is easily liable to misinterpretation, and for this reason we hesitate to comment on it, but some features of the organisation seem to be beyond doubt. Thus it would appear that the head of the statistical division is an administrative officer (as distinct from a person holding the position by

virtue, *inter alia*, of statistical knowledge), and that the division contains four other administrative officers, through whom passes the chain of authority to all the subordinate officers of the division. The statisticians appear to have the role only of technical advisers outside the main channel of responsibility.

9. We do not think this organisation is well suited to the needs of the community to-day. As we have said above, we assume that the analysis of statistics should henceforth be regarded as of major importance among the functions of the General Register Office; that in future, the Office should be judged mainly by its success in performing this work. If this view is accepted, the organisation of the department should be made to reflect the priorities it implies. We think there should be a Statistical Division in which not only the headship but all the responsible positions would be held by qualified statisticians. The head of the division should have direct access to the Registrar General. The Statistical Division should be responsible for all tabulations and all statistical analysis, and should be given an important voice in all decisions bearing on the collection of information. It should have under its own control facilities for machine tabulation and computing. Its members should be free, within the limits of official secrecy, to engage in discussion of technical matters with students of population outside the government service in this country or abroad.

10. The existence of such a Statistical Division would go far to ensure that the statistical work of the General Register Office should flourish. Some may question whether it goes far enough. Our former colleague, the late Dr. Kuczynski, for example, proposed(1) that the work of statistical analysis should be removed altogether from the General Register Office to a new office created for the purpose, leaving to the General Register Office the administration of the censuses and civil registration which provide the raw material for statistical work. Separate offices on these lines exist in many foreign countries. But the arrangement has one serious disadvantage, namely that the separation of the statistician from the collection of information would seriously reduce his ability to influence the nature of the information collected. At a time of rapid development in the technique of analysis of population statistics, the influence of the statistician over his material needs to be strengthened rather than diminished.

11. Another proposal which we have considered is that the head of the Statistical Division should be given a special status vis-à-vis the Registrar General, like that possessed by the Chief Medical Officer of the Ministry of Health vis-à-vis the Secretary. This would enable the requirements of the statisticians to receive their due priority and ensure them freedom and independence in their work. On the other hand, it would divide authority; and the judgment of the Royal Commission on the Civil Service of 1929–31 stands opposed to any fresh arrangements of this kind.(2)

12. Assuming that neither of the two proposals mentioned is likely to commend itself, we think that it would be very desirable that in future the Registrar General should normally be himself a person qualified to deal with statistical issues. It has not hitherto been considered necessary (in England and Wales at least) that the person appointed to the position of Registrar General should have any statistical experience, whether in the demographic field or any other. The appointees have been (in recent years) administrative civil servants chosen on grounds of all round administrative ability. This

(1) "Demography—Science and Administration", *Eugenics Review*, April 1945.
(2) *Report of the Royal Commission on the Civil Service*, 1929–31 (Cmd. 3909), para. 177.

method of appointment reflected the former attitude towards the General Register Office, in which statistical work was regarded as subsidiary to administration; and great services have been rendered to the nation by the Registrars General so appointed. The new importance which, as we have argued above, must henceforth be attached to the statistical work of the department demands a different approach from now on. The actual work of the Registrar General is mainly administrative and must be expected to remain so; but the most important part of his administrative work is related to the process of collecting and analysing statistics. It is no longer considered that administrative work of this kind can be performed only by non-specialist administrative civil servants; indeed it is obvious, and has recently been officially recognised, that for such work the qualified man has a decisive advantage. Thus the Statistical Division of the Board of Trade, headed and largely staffed by statisticians, has charge of the Censuses of Production and Distribution which involve a large amount of administration. We think, therefore, that for future appointments to the position of Registrar General some experience of, and competence in, statistical work should be a necessary condition; while a formal statistical[1] training, though not essential, should be counted a considerable advantage. Ideally, the person appointed should have some knowledge of population and vital statistics; certainly such knowledge should be regarded as an important qualification; but it should not be a *sine qua non.*

13. Whereas there did not exist formerly more than a handful of men who combined statistical training with administrative experience, there is now coming into existence, as a result of the growth of statistical divisions in government departments (including the Central Statistical Office) a considerable body of such men.

14. The question of the qualifications to be required in future appointments to the position of Registrar General is entirely independent of the proposals made in paragraph 9 for the reorganisation of the Statistical Division of the General Register Office. We wish to recommend strongly that such a reorganisation should be effected as soon as possible.

15. In the General Registry Office for Scotland, the problems are somewhat different from those of England and Wales. The Statistical Division is small and the scale of analysis so far attempted has been, in general, less ambitious than in England. The future may bring expansion and we hope that in its development the desiderata we have stated above will be kept steadily in mind. Even more important, however, is that arrangements should be made to remedy the present lack (to which we have also called attention in our report on the analysis of fertility statistics) of detailed statistics for Great Britain as a whole. Present arrangements for co-ordinating the work of the two General Register Offices do not lead to the production of statistics for the whole area except in respect of a few elementary matters; they do not even, in some cases, ensure that the definitions and categories adopted are similar in the two areas. Further, all discussion and analysis are related to the separate statistics of one area or the other (England and Wales having by far the greater share): for Great Britain there is none whatever. One result of this deficiency has been that the preparation of statistical material for the Royal Commission, whose terms of reference relate to Great Britain, has been more difficult and less satisfactory than it should have been. Nor should it be thought that this is unsatisfactory only from the point of view of a temporary investigation

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(1) Here and elsewhere in this report statistical qualifications are to be read as including actuarial qualifications.

bound by *ad hoc* and somewhat arbitrary terms of reference. On the contrary, Great Britain defines an area which is permanently of greater demographic interest than either England and Wales or Scotland considered by itself.(1) It is highly desirable that in future the discussion of such subjects as reproductivity and the probable future of the population should be related mainly to the population of Great Britain. This would not, of course, in any way rule out the carrying out of similar investigations for England and Wales or Scotland (or any part of either) separately.

16. It is safe to say that the necessary statistical material for Great Britain will not be compiled, let alone analysed and critically discussed, unless the present official arrangements are altered in some way. At present no one has any responsibility to produce or analyse statistics for Great Britain, and until such a responsibility is created the work will not be done. It is therefore recommended that the General Register Office for England and Wales be given this responsibility, with the clear understanding that what is expected is not merely the publication of a few figures for, e.g., population, births, deaths and birth and death rates for Great Britain, but a full analysis of the forces determining population growth, life tables, the trend of nuptiality and family size, and so on in *at least* as detailed a fashion as applies to either of the constituent areas. The Scottish General Registry Office would obviously have the responsibility for providing data and estimates in the form required for the Great Britain analysis; it would remain, of course, entirely free to undertake analysis and research on matters special to, or of particular importance to, Scotland.

17. We understand that in evidence given to the Royal Commission certain proposals have been made for the setting up of a completely new official Institute of Demographic Research. These proposals envisage for the new institute a much wider field of research than the study of population statistics in the narrow sense, with which we have been concerned in the previous paragraphs of this note. The field would include the study of medical, psychological, social and economic factors connected with population trends, including the repercussions of government policies in diverse fields—housing, education, taxation, etc.—on the trend of the birth rate. Other advocates of the establishment of a new institute have laid stress on the imperial aspect of demography. They recommend the establishment of an office in which trends of population in the Dominions and other countries of the Empire would be studied alongside those of the United Kingdom.

18. We have not studied the details of these proposals, most of which seem to lie somewhat outside the scope of this committee. We do wish, however, to urge strongly that support should not be given to any plan which would remove from the General Register Offices the main work of studying the ordinary demographic statistics of Great Britain. The General Register Office is in our view the right department to carry out the statistical analysis of British population trends. No new body could be so well placed, for example in respect of control of the sources of information. We hope therefore that no proposal involving the transfer of this work from the General Register Office will receive encouragement.

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(1) It might be argued that a still wider area, the United Kingdom, would be still better than Great Britain as the unit for demographic analysis. As the primary political unit it would have strong recommendations. There might be technical difficulties in unifying the statistics, however; and the facts of transport and geography have implications in the demographic field which give the choice of Great Britain certain countervailing advantages. Fortunately (from this point of view) the proportion of the population of the United Kingdom which is outside Great Britain is small (3 per cent.).

The Statistics Required for the Analysis of Fertility

I. REPORT TO THE ROYAL COMMISSION BY THE STATISTICS COMMITTEE

1. The present memorandum deals exclusively with the basic official statistics required for the analysis of fertility. Although this is only one section of the field of demographic inquiry, it is a critical one. War and migration apart, future population trends will depend primarily upon the extent to which people marry and the degree to which they restrict their fertility within marriage. The prospective course of the population, its growth or decline, and the changes in its composition, are all of direct and practical relevance to the community. If, as we believe to be the case, the improvement of the basic statistics relating to fertility, and of the techniques of analysing those statistics, will result in a more comprehensive and realistic diagnosis of fertility trends, the practical as well as the academic field will gain substantially thereby.

2. Restricting the present discussion to fertility analysis does not confine it to birth statistics alone. Marriage, divorce and death statistics are also necessarily involved, but they are involved only to the extent to which they are required in order to allow appropriate analysis of birth statistics. In particular, birth statistics need to be related to the relevant base populations. As will be seen later, modifications in the collection and tabulation of marriage, divorce and death statistics are necessary if births are to be related to the populations to which they most nearly correspond. In the main, however, it is with the statistics of births that the memorandum is concerned.

Development of Fertility Statistics, 1837-1938

3. Official vital statistics were initiated in 1837 in England and Wales and in 1855 in Scotland. Under the registration systems then established, births were analysed only by sex and legitimacy, and the birth rate (in various forms) was the sole concept used in the study of fertility in this country([1]). This situation remained substantially unchanged for a hundred years; the overwhelming interest, during the nineteenth century, was in problems of mortality. Thus, while the analysis of mortality expanded and became a model for the rest of the world, fertility was generally neglected.

4. The one exception of importance was the Fertility Census of 1911, taken as part of the general census. This, one of the earliest fertility censuses, was pioneer work. It threw much light on fertility trends in the late nineteenth century and approached the problem of fertility analysis not through the birth rate, or any variant of it, but through the concept of family size. At the same time it had a major limitation. Because it did not ask for the date of birth of each child born to every married woman, the Fertility Census did not allow any serious study of incomplete fertility—that is, of women who were under 45 years of age at the time of the Census. This also meant that the most worthwhile findings of the Census related to a period substantially earlier than 1911, and were to this extent mainly of historical interest by the time they were published.

5. The Fertility Census of 1911 was not repeated. And though interest was expressed in the taking of further fertility censuses, far more interest was aroused by the question of the extent to which populations were currently replacing themselves and by the techniques for studying this question. These techniques

([1]) A much more comprehensive analysis was provided for Scotland, but was abandoned after the first year of operation.

—reproduction rates and their derivatives—were largely developed in the late nineteenth and early twentieth centuries, but their application depended upon the provision of more comprehensive birth data than were generally available at the time and, in particular, upon the knowledge of the age of the mother at the birth of a child. Such information was not available for Great Britain. Thus, as interest in population questions grew in the 1930's, stimulated primarily by the prospect of a declining population in Great Britain, it focused upon the desirability of so extending our vital statistics as to allow the regular calculation of reproduction rates. The result was the Population (Statistics) Act of 1938, the first major change in our vital statistics for a hundred years.

Possibilities Opened up by the New Statistics

6. The new Act was not designed simply to supply data from which reproduction rates might be calculated. It went beyond this and provided that order of birth and duration of marriage, as well as age of the mother, would be ascertained in respect of each legitimate birth. The resultant fertility statistics are as comprehensive as those of any other country and far more so than those of most other countries. Their comprehensiveness has opened the way to further studies of fertility which can add greatly to what may be learned from the calculation of age-specific fertility rates and of measures such as reproduction rates based on them. If, as has happened recently, the number of births changes considerably from one year to another, it is natural to ask whether statistical analysis cannot throw any light on possible causes of the movement, and help anyone who wishes to evaluate its significance in the discussion of future trends of population. Moreover, such analysis is highly desirable because of the inconclusive, and possibly misleading, indications provided by the usual reproduction indices in such circumstances. The new statistics make it possible to analyse the births in ways which are of great value from this point of view.

7. This has been especially visible for the period since 1933. The detailed studies prepared for the Statistics Committee have given much attention to this period, one in which annual fertility rates have suffered what at first sight seem highly erratic and somewhat incomprehensible fluctuations. These studies have confirmed that these movements were compatible with a fairly gradual change in the family pattern, defined as the distribution of families by size among married couples who have been married for a fairly long period. Moreover, the trend of the family pattern could hardly have been discovered from any study confined to age-specific fertility rates.

8. It is evident that there may be wide annual fluctuations in birth or reproduction rates, resulting from short-term postponement or the termination of such postponement, while ultimate family size remains relatively stable. If, therefore, the significance of annual fertility rates is neither to be over- or underestimated they need to be put in their proper setting by being related to the *previous* fertility history of the relevant group of married couples. If we are studying the births of say, 1948, we need to know how many of the married couples now in the childbearing age had already produced one child, two children, and so on, by the beginning of 1948 as well as knowing how many such couples there are and how they are distributed by duration of marriage. Then, using the statistics of births recorded in 1948 (as well as of dissolutions of marriage by death or divorce) we can prepare a similar table showing the position at the *end* of 1948. It is only in the light of the comparison between these two tables that the significance of the births of 1948 in terms of family size can begin to be appreciated, and the question of replacement of the population itself cannot be adequately studied without reference to family size as well as to specific fertility rates.

9. To make this comparison requires an approach rather different from that commonly applied in the field of demography. It means tracing the reproductive performance of specific groups of women at each stage of their marital history. Beginning, for example, with women marrying for the first time in 1939, it would be necessary to know how many of these women had had children (and whether first, second, third children and so forth) in each year from the time of their marriage. Such statistics would show not only the movements in *average* family size for each group of women and at various durations of marriage, but also the *distribution* of family size—how many childless, how many one-child families, and so forth—and their variation. The provision of statistics on the above lines requires the linking together of the various sets of vital phenomena. That is, it is necessary to relate the births occurring in various years to the specific groups of married women to whom they occur.

Conditions for Satisfactory Analysis of Changes in Family Size

10. The fertility data made available from birth registrations since 1938 can provide a basis for an analysis of this kind. But the work of analysis could be made very much easier and its results more reliable, if two conditions which have not been satisfied in the past were to obtain in future. They are:

(1) that the collection and tabulation of registration data had been deliberately planned so as (*inter alia*) to facilitate the carrying out of such an analysis, and

(2) that there were available, as a basis for the building-up year by year of estimates of the pattern of family size, the results of a fairly recent family census planned so as to discharge this function.

11. Each of these conditions requires some explanation. We discuss in an appendix the requirements under the first head, and make recommendations for certain comparatively minor changes in the present system of collection and tabulation of registration data. They may be summarised as follows:

(1) certain modifications of detail in the questions put at birth registration;

(2) a small number of additional questions at the registration of the deaths of married persons, to enable the necessary adjustments of the married population to be made;

(3) the preparation in statistical form by the Divorce Court authorities of certain information already in their possession;

(4) the tabulation of statistics of births in a particular form which is convenient for the kind of analysis discussed above.

12. As regards family censuses, we are not, of course, supposing that their sole or even their main justification lies in providing a basis for the analysis of subsequent births. They have a very great intrinsic value as recording the past history of family size. In addition, however, they can provide a basis for the estimation of the population relevant to fertility analysis in the period elapsing between each such census and the next. For these reasons we hope it may be assumed that in future family censuses will be taken from time to time in association with general censuses. We wish to emphasise the importance of their regular repetition. The census distribution of families by number of children, duration of marriage, etc., could be continuously brought up to date with the aid of registration data so as to provide estimates for later dates (in the same way as estimates of the total population are now obtained). For this to be possible it would be necessary to coordinate the categories of the family censuses with those of the registration data.

A Central Family Index

13. In the last paragraphs we have been considering how the existing methods of preparing statistics from registration data could be so adapted in detail as to facilitate tracing the reproductive performance of specific groups of married couples at successive stages of their married lives. There is, however, another method by which this end could be sought, a method involving a much more considerable modification of present methods, but offering considerable additional advantages. This is the institution of a central system of family histories made by linking up in a central office different civil registrations affecting the same family, a proposal which has been made on a number of occasions in the past.

14. One form of this proposal (doubtless there are other possible variants which would be equally good) is that a family card should be opened at the headquarters office of the Registrar General for each marriage of which notification is received. On this card would be recorded the dates of birth of the husband and wife, the date and place of the marriage and the occupations of husband and wife. When, subsequently, any event involving these people, e.g. the birth of a child to them, was the subject of civil registration, a note of the occurrence would be entered on the family card. For this purpose it would be necessary that sufficient information should be obtained at these registrations to enable the right card to be found. Whether the details already obtained at, e.g. birth registration would be sufficient for this purpose needs further exploration.

15. The events which it would be essential to record in the family card would include, besides the births of children, the death of either parent, or their divorce. It would be desirable, though not essential, also to have recorded the deaths or marriages of the children (on the marriage of a child, the new card opened could contain a cross-reference to the parents' card, but any further events in the child's life would be recorded only on the new card). Ideally the emigration either of the husband or of the wife should also be recorded.

16. It might appear that the institution of a central index along these lines could with advantage be combined with some of the population records kept for the purposes of the National Insurance system. There may be serious practical difficulties in the way but we think the possibility of utilising existing records as a basis should be explored.

17. It is hardly necessary to elaborate the advantages, from the point of view of statistical analysis, which would be yielded by the maintenance of a family index in which records of civil registration were linked up in the manner suggested. The problem of estimating the related populations for this purpose would be greatly eased. A family census, complete or sample, could be taken at any time without asking any questions of individuals. Detailed studies of the 'family-building habits' of particular sections of the population would be facilitated. More generally, the distribution of any of the characteristics recorded could be investigated in relation to any of the others. It would be possible to study fertility with a thoroughness and detail which could never be achieved under the existing system, even if improved in the ways mentioned above. Registration and census data would be automatically harmonised and there would be none of the difficulties which have arisen in the past, e.g. in occupational analysis, through divergence between the answers given by members of the public to the same questions asked in two different contexts.

18. The cost of the proposal would consist in an additional volume of clerical work at the Registrar General's headquarters office. To set against this, there would be some saving on the family censuses, which as explained

in para. 12 above, we trust will be taken periodically in future.(1) Once the family index had been set up, the main purpose of the family census would be radically changed: it would lie not so much in itself providing information, as in constituting a check of the accuracy of the central index—a matter, it must be recognised, of considerable difficulty and expense. The scope of the ordinary population census would be completely unaffected by the proposal.

19. Making the assumption that the trend of population must henceforth be regarded as a matter of serious national concern requiring close study, we believe that the value of a central family index would greatly outweigh its cost, though we are not in a position to make firm estimates of the cost of our proposals. We therefore recommend that the possibility of establishing and maintaining such an index and of setting up the necessary organisation for the analysis and interpretation of the material thus provided should be examined as a matter of urgency by the responsible authorities.

20. If the decision were taken to institute a central index of this kind, the simplest way of starting it off would be to fix an initial date and open family cards for all marriages recorded after that date, as they occurred. Under this method about 30 years would have to elapse before the population of fertile married women was completely covered by the index, though it would be contributing considerably to our knowledge of fertility movements within a much shorter period—say after 10 years. If it were desired to obviate this period of waiting, and start the index off with a complete record of existing families, it would be necessary either to take a special family census for the purpose, or to include the relevant questions in the next general census.

Migration

21. To keep track with complete accuracy of the populations relevant to the analysis of birth and marriage statistics would require that all migrants should be identified and recorded as such, and this is equally true whether or not the family index is instituted (the effect of having the family index would be to *reduce* the number of questions that would have to be put to a migrant). Migration is a complex of movements differing in various respects (inward or outward direction, nationality of migrant, sea or air transport, European or overseas voyage, etc.) which are highly relevant to the possibilities of obtaining information. Moreover, the needs of fertility analysis are only a minor part of the considerations relevant to migration statistics. For these reasons we decided not to include in this report a discussion of the existing arrangements for obtaining statistical information about migration or of possible changes. Under the existing arrangements for obtaining information, there is no doubt that migration would create certain difficulties for the administration and use of the family index; we do not think, however, that these difficulties, even if nothing were done to reduce them, would be so great as seriously to impair the value of the index.

Occupational Analysis

22. We think it desirable that marriages and births should be analysed periodically by occupational group in a standardised classification. As regards marriage, a full study of occupational differences, using ' proportions married ' and marriage rates, will be possible only in census years, since only then are the occupational populations known. We think that such a study should be made at each census period, and this implies not only that occupations are recorded at the census, but also that satisfactory information is available about the occupations of persons marrying in that period. Occupation is, indeed, already asked at marriage, but in England and Wales at least, the

(1) The Sample Family Census taken by the Royal Commission on Population in January, 1946, cost about £160,000.

information so obtained is not satisfactory. We have been informed that satisfactory details are already being obtained in Scotland; and it is very desirable that a similar state of affairs should be achieved in England and Wales. The difficulties in the way of achieving this do not seem to us to be insuperable.

23. As regards births, it is now clear that an essential object of study must be occupational differences in family size (and 'family-building habits' in general). Analysis in terms of e.g. fertility rates of married men under 55 can no longer be regarded as sufficient. If a family index is instituted, the material will be available for occupational analysis of family size, spacing, etc., on any scale and in any detail desired. If it is not instituted, it will be only when a family census is taken that full occupational analysis will be possible, and indeed this is one of the reasons why the absence of a family index increases the need for family censuses (we assume that occupational analysis would be a normal feature of future family censuses). In either case it is important that there should gradually be made available a series of statistics for different periods, using throughout the *same* measures of fertility, and the *same* classification of the population into socio-economic groups.

24. The existing system of occupational grouping will doubtless be reconsidered. It may be suggested that the existing grouping into five social classes is too broad, involving the creation of very heterogeneous collections of occupations. There is a need for a method of grouping into a relatively small number of classes (larger than five but still manageable), which could be used—as the full detail of 1,000 occupational groups could not be—for analyses taking place at fairly frequent intervals.

Time-Schedule of the Analysis

25. Not all of the analyses we have proposed would necessarily be done each year; some of them might take the form of special studies using data of a period of 2, 3 or more years, and appearing at regular intervals as part of a planned programme of work designed to spread evenly the commitments of the staff engaged upon it.

26. Many other subjects for special occasional study will no doubt suggest themselves; we mention only one, which would be of great value to students of the official statistics. This would be a study of the accuracy of statements made at registration and census as to age at marriage, duration of marriage at maternity, etc., on the lines of the studies of age statements which are frequently made.

Statistics for Great Britain as a Whole

27. A general question, which has to be decided in relation to all the proposals made above, is the area which statistical publications should cover. The present complete separation between the Registrars General of England and Wales and of Scotland has several disadvantages from the statistical point of view. Inter-censal estimates of population (and practically all analysis must be based on these) are more accurate for Great Britain as a whole than for either of the parts because of the importance of migration between Scotland and England. Moreover, detailed statistics for Great Britain (which for most purposes is the primary unit of interest) can only be obtained with great difficulty. The gigantic task of adding together all the corresponding figures in tables of marriages by age and conjugal condition or the complicated fertility tabulations now available under the 1938 Act cannot be undertaken by private students. Nor should the task be left to them. Indeed, it is at present impossible in some cases because of the differing classifications occasionally adopted by the Registrars General. It is clearly desirable that a regular supply of statistical material relating to Great Britain as a whole should be forthcoming. We make a recommendation to this end in another Report (*Report on the Organisation of Official Work on Population Statistics*, para. 16).

APPENDIX

REGISTRATION DATA

1. In the main text of our report we advocate that the scope of regular fertility analysis should be extended to cover a study of the family pattern and its development. In concrete terms this means that the statistics for any year should be such as to make it possible to draw up a table showing the distribution of married couples by duration of marriage, age at marriage, and number of children. For this purpose it would be necessary to have information in a particular form about marriages, births, deaths, and divorces in the year under consideration and in a certain number of previous years.

Marriage

2. The information now collected at marriage is sufficient for the purposes of analysis of the kind described for the population as a whole(1) and need not be further discussed here(2).

Births

3. The basic table of births required for the kind of analysis here presupposed is one in which they are classified by order in combination with duration of marriage(3). Duration of marriage and order of birth are already being asked at registrations of legitimate births under the Population (Statistics) Act, and are made the basis of published tables. The figures thus produced are not, however, in all respects as suitable for the analysis of the family pattern, as they could fairly easily be made. The points arising are conveniently reviewed by considering the exact meaning which ought to be attached to the important nouns in the phrase 'a table of births by order in combination with duration of marriage'.

Tabulation of 'Births' by 'Order'

4. 'Births' and 'order' are best considered together, for the following reason. For the cumulative estimation of families by size, it is convenient that current 'births' should be defined in the same terms as the 'number of previous children' which defines order. For example, if the current events analysed are 'live births' the definition of previous children should be in terms of previous live births. At present, the current events tabulated by birth-order are 'maternities', but their order is defined, not in terms of previous maternities, but of (*a*) previous live and stillbirths, and (*b*) surviving children. The resulting statistics cannot be used for the cumulative estimate of family size without troublesome calculation with results subject to some error.

5. There is a considerable choice of possible tabulations. 'Births' has at least three alternative meanings, first 'live births', second 'live and stillbirths', third 'maternities' (a multiple birth is counted as one 'maternity' only).

(1) The information obtained at marriage about occupation is discussed in para. 22 of the main report.

(2) A minor point about the tabulation of marriages may be mentioned here. As divorce becomes more common the procedure of classifying marriages of divorced persons as marriages of bachelors and spinsters becomes cumbersome. We recommend that the marriages of divorced persons should be separately given by single years of age as are those of other persons. This suggestion is, of course, quite independent of any changes in the registration system, and could be put into effect immediately.

(3) For a full study it would also be necessary to subdivide by age at marriage, and it is to be hoped that a table divided in this way will be published in future (at present the only table published by the Registrar General which gives a classification of duration and order combined is divided only by the age of the mother at maternity, in quinquennial groups).

6. Corresponding to these are three alternative definitions of 'previous children', and there is also a fourth, namely *surviving* previous children. Assuming that the definition of 'births' and of 'previous children' should be coordinated for the reason given above, there remains the question which of these alternative definitions should be adopted for the tabulation which is to be the basis of the analysis of family size.

7. The choice of live births as the unit for the main analysis of current fertility would accord with the normal practice of past fertility analysis in this and other countries. Taking 'live and stillbirths' may have a certain advantage from the biological point of view, since it does not treat as infertile a woman who had had a stillbirth but no live birth. On the other hand, it probably involves a lower degree of correspondence between birth-order in the statistical sense and the sense in which it has social significance, e.g. it puts into the same category of 'women having third births' woman A who has had two live births and woman B who has had one live and one stillbirth. It is true that this line of thought seems to point to 'surviving children' as the best basis, but this is ruled out, at least for adoption by itself, by the extreme difficulty of estimating the relevant populations at risk (assuming that fertility questions could not well be introduced at the registration of the deaths of children). To base everything on 'maternities' would incur what seems the decisive disadvantage that if 'number of previous maternities' were to be recorded at birth registration, its exact meaning would have to be carefully explained on each occasion—whereas 'number of previous live births', for example, would be readily apprehended(1). It seems to us, therefore, that the balance of advantage lies with the choice of live births as the units of tabulation, and the definition of order in terms of previous live births.

8. At present the number of previous live and stillbirths (together) to the mother, and the number of her surviving children, are asked at birth registration, but not the number of previous live births. We recommend that this question should be included. Moreover, the unit in tabulations by order of birth is at present in all cases the 'maternity'. We recommend that there should be a tabulation in which the unit should be the live birth.

'Duration' of Marriage

9. The definition of 'marriage duration' for purposes of tabulation of current birth statistics raises an important question. At present births are tabulated by number of completed years (or months) of marriage after which they occur. The populations at risk relevant to statistics of this kind (e.g., the average number of women who in a given year were married more than 2 but less than 3 years) can never be estimated with complete accuracy. Nor is it very satisfactory to use statistics of this kind to obtain estimates of the distribution of marriages of a given duration by the number of previous children. An alternative method is to analyse the births of each year by the mother's year of marriage. The number of marriages contracted in a given year is quite definite, and the accurate estimation of the number still in existence at some later period is a fairly easy task if the records of deaths, divorces, and migration are adequate and suitably tabulated.(2) Moreover, the number of births to such marriages taking place in subsequent years can be added so as to give the distribution of the married couples, at the end of the period, by the number of children born. If this method of tabulation is adopted, the analysis of fertility according to marriage duration has to be based on the difference between

(1) It may be worth recalling that all these difficulties, so far as they relate to the collection of information, would be obviated by the institution of a central family index.

(2) Tabulation by marriage duration should be by single years throughout, in order to make it possible to identify the same cohorts of women in successive years.

the year of marriage and the year of birth. Such a definition may at first sight seem peculiar because the period of marriage duration so defined (*a*) differs for women who married at different times of the year, so that ' duration ' has no clear-cut and uniform meaning throughout the group; (*b*) may differ *on average* between two cohorts of women occupying the same duration group in successive years. The first point is important in so far as the fertility rate of a particular duration-group is interesting *per se*; since, however, the use of such fertility rates in analysis nearly always lies in their being *compared* with rates for other duration-groups or other years, or combined therewith to produce some composite index, it does not seem to have much weight in practice. For these purposes it is only (*b*) above which might be of importance; however, the differences from year to year in the average date of marriages are generally negligible in relation to all but the very shortest periods of marriage duration(1). For any detailed study of these periods—say the first two years—a special analysis by *month* of marriage duration would be required in any case, whatever the nature of the main duration tabulation.

10. Thus the disadvantages of this method of tabulation do not appear substantial. Its advantages, on the other hand, in the way of exact knowledge of the size of the basic cohort, and of its distribution by family size, should be considerable. We think, therefore, that its adoption should be seriously considered.

The Segregation of First Marriages

11. From the point of view of fertility analysis, women who have been married more than once form a group which differs significantly from that of women married once only. The ascription of the births of their children by marriage duration and by order raises problems from which the latter group are free. For a complete analysis of the fertility of re-married women, indeed, it would be necessary (*a*) to ask not only the dates of all their marriages but also the dates of termination of their previous marriages (at present only the date of the present marriage is obtained), (*b*) to ask the number of previous children of each marriage separately (this is, in substance, done now). It is, however, doubtful whether the separate analysis of the fertility of re-married women is at present a subject of sufficient importance to justify collecting full details. It is clearly desirable in principle that it should be possible to isolate the births to women married once only, so that in respect of this group—which includes the great majority of fertile married women—the possibilities which it holds out of clear-cut analysis may be realised. Unfortunately, for complete success in this aim it would also be necessary to ask questions about previous marriages when records of deaths of married persons or of divorces were being collected, and in the case of death at least, the justification for doing this might not appear sufficient.

Deaths

12. We are here concerned with deaths, not from the point of view of mortality analysis, but as an agency affecting the populations relevant to the analysis of fertility. Of the details needed from this point of view, some (age, marital status, age of spouse) are already obtained. In the case of deaths of married persons, the date of marriage should be obtained in all cases (at present it is obtained at the deaths of *women* who are or have been married, but not at deaths of men). The number of children of the marriage should also be obtained. If it is feasible to obtain the information whether, in any marriage dissolved by death, the wife had been married more than once, it is desirable that this should be done.

(1) The difference in average date of marriage between 1938 and 1939, when it was quite exceptionally large, was about 0·7 months. For all marriage durations greater than 5 years this would be less than 1 per cent. of the total duration. And for years

Divorces

13. At ages under 45 divorce has now become as important a factor as death in the dissolution of marriages. The information relevant to fertility analysis which is at present available about divorces is seriously incomplete. It relates only to persons seeking divorce in London, and does not give, even for them, all the particulars which it would be desirable to have for the purposes of statistical analysis of births.

14. We therefore recommend that the following information should be provided to the General Register Office (in statistical form) by the Divorce Court authorities in respect of all divorces granted and also in respect of decrees of nullity whether in London or elsewhere.

1. Date when the marriage which is being dissolved took place ;
2. Whether (*a*) the husband (*b*) the wife had been married previously;
3. Date of birth of each spouse;
4. Occupation of husband at time of divorce;
5. Number of children born alive during the marriage being dissolved.

15. We understand that this information is already available to the Divorce Court authorities, and needs only to be collected and analysed.

Summary of Recommendations on Registration Data

1. *At Birth Registration*

(*a*) the number of previous live births to the mother should be asked;
(*b*) it should be enquired whether the mother had been married more than once.

2. *In the Tabulation of Statistics of Births*

(*a*) there should be a table of live births by number of previous live births, in combination with duration of marriage;
(*b*) the adoption of a 'calendar year' basis for definition of marriage duration should be seriously considered.

3. *At the Registration of Deaths of Married Persons*

(*a*) the date of the marriage should be asked in all cases;
(*b*) the number of live born children of the marriage should be asked;
(*c*) the possibility of enquiry whether the wife had been married more than once should be seriously considered.

4. *The following information about divorces* should be furnished to the General Register Office by the Divorce Court authorities:

(*a*) date when the marriage which is being dissolved took place ;
(*b*) whether (*a*) the husband (*b*) the wife had been married previously;
(*c*) date of birth of each spouse;
(*d*) occupation of husband at time of divorce;
(*e*) number of children born alive during the marriage being dissolved.

RESERVATION BY MR. V. P. A. DERRICK

I agree that the recommendations, including those of the appendix, deserve careful consideration by the government departments responsible for the planning of our national fertility statistics.

Apart, however, from the fact that some of the statistical arguments set out in support of the recommendations are open to question, the implementation of the recommendations involves matters of policy and practicability which are outside the scope of the Committee's determination, and it is to be understood that as an officer of a department responsible for developments in this sphere my concurrence in a recommendation for their careful consideration in no way prejudges the practicability or ultimate desirability of giving effect to them.

II. COMMENTS BY THE REGISTRAR GENERAL FOR ENGLAND AND WALES

1. The Registrar General has considered with his advisers the provisional report which the Statistics Committee has submitted to the Royal Commission. He desires to submit to the Commission the comments set out below. He observes from the letter sent to him with the report that the request for his comments is limited to " the cost and administrative workability of the Family Index which they (i.e. the Statistics Committee) propose ". These are included in Part I of this paper. He has, however, thought that it might be of assistance if consideration were also given in this paper to the alternative proposal put forward to the Commission by the Statistics Committee, and if some general comments were added. Part II of this paper deals accordingly with the Family Census and registration data as an alternative to a Family Index; Part III contains provisional conclusions on the proposed Family Index and alternative methods; and Part IV refers to occupational analysis and certain other matters mentioned in the Committee's report. Needless to say the Registrar General and his advisers would be happy to discuss any of these various matters at any time with the Commissioners.

Part I—A Central Family Index

2. The Report reviews the present extent of the material available from basic vital statistics and the analyses of fertility derived from these. Annual fertility rates show considerable fluctuation and the Committee draw attention to the trends in family pattern which they suggest have been more gradual. They emphasise that in studying fertility trends and replacement of the population it is essential not to confine enquiries to changes in the birth rate or any variant of it, but to study also the facts of family size; it is necessary to trace the reproductive performance of specific groups of married couples at successive stages of their married lives and to secure statistics showing not only the movements in average family size for each group of women and at various durations of marriage but also the distribution of family size throughout the population.

3. The Report considers two methods of obtaining the necessary statistics, one, the periodical estimation of family size based on the figures of a recent family census brought up to date with the aid of registration data, the second, the institution and maintenance of a central Family Index. The main difference between the two methods consists in this, that the former implies sets of basic figures corrected at intervals by fresh figures, whereas the latter requires up-keep of continuously up-to-date records giving the vital history of individuals composing the family group, statistics being based directly upon these. The periodical analyses would be obtained not from fresh data but by retabulation of the corrected cards. The project entails the compilation of records of individuals whose identity must be preserved and the linking with those original records of subsequent registration of births, marriages, deaths and other particulars. The Committee are careful to emphasise that the institution of a Family Index must not be regarded as dispensing with the need of periodical family censuses; both a periodical family census and the continuance, or even expansion, of data under the Population (Statistics) Act, 1938, would be indispensable to the proper checking and maintenance of the Family Index.

4. Subsequent paragraphs in this paper indicate a possible approach to the construction of a Family Index. It should, however, be noted here that since such an Index would not dispense with the cost and labour of existing methods of obtaining fertility statistics, it is necessary to examine not only

cost and workability but also whether the Index is so desirable in the public interest as to warrant its being superimposed as an addition to existing methods, however much these methods might be improved by adaptations such as the Committee suggest.

5. The Committee indicate briefly what information a Family Index should contain, and suggest, as a possible method to be explored, that a family card should be opened at the Headquarters Office of the Registrar General for each marriage of which notification is received. An Index would be built up containing cards for all marriages in England and Wales as they take place. In order to facilitate linkage of subsequent events, the cards for each year's marriages might be kept in a separate annual series. Subsequent data would be derived, *inter alia*, from information given under the Registration Acts and the Population (Statistics) Act, 1938.

6. The approach to working out the scheme might be somewhat as follows:—quarterly certified copies of all marriages solemnised in England and Wales are received at the General Register Office under the Registration Acts; index cards might be transcribed from these showing names, ages at marriage, place of marriage, marital condition of spouses and occupation of husband. In addition there would presumably have to be entered on the cards particulars of any previous marriage of the wife and of the births and deaths of any children of previous marriages; the information would have to be obtained by the clergyman or other registering officer at the time of the marriage. (This would need legislation). The cards would then be set up in annual series by order of surname to give an index of all new families formed during the year. At every birth registration the informant would have to give the particulars at present required by law for the Birth Register and statistical purposes (e.g., names of parents and date of marriage) and also, in addition, the place of marriage of the parents, in order to identify the family card on which entry of the birth should be recorded. (Place of marriage is needed to identify married couples with the same combination of names—e.g., the John Jones' who marry the Mary Jones'). At every death, or marriage, of a child similar questions, relating to the marriage of the parents, would be required in order that the right family card should be noted. When any marriage is terminated, either by divorce or the death of either spouse, similar identifying particulars would be required in order that the card could be marked. The index would thus theoretically contain a card showing the life history of each member of the family; entries relating to the children could, as suggested by the Committee, cease after they married. The identifying factors would be the date and place of the marriage and the names of the parties.

7. The working of such an index would be inevitably hampered by failures both in recording and in linking, due to a variety of causes. Linkage failure, due to wrong names, changes of name, ignorance or imperfect memory concerning dates and places of marriage, would involve heavy follow-up enquiries with only partial success. The effect of failures in recording would probably be even more serious since it would occur mainly in respect of emigrants, a class of which it is notoriously difficult to obtain a satisfactory record even of their numbers whereas comparatively extensive statistical details would be required to locate them in the Index. The cumulative effect of failing to allow for loss amongst possibly 50,000 married women emigrants per annum, mostly of childbearing age and probably with a select fertility characteristic, would be serious.

8. The Committee in paragraph 20 of their Report suggest that the Index should operate from a given date without retrospective action, the cost (and utility) not reaching the maximum for some 30 years. This must be subject

to the qualification, as regards cost and labour, that while the Index was being built up over the 30 years or so, all maintenance records—births, deaths, divorces, migrations, etc.—would have to contain the enlarged identification particulars and be subject to scrutiny to ascertain whether the events recorded belonged to marriages for the time being within the Index, and thus much effort would be wasted; this would of course diminish as the Index became more and more complete.

9. In addition to the machinery for establishing and maintaining the Index as outlined above there would be the statistical organisation for analysing and interpreting the material. It would be necessary to punch a set of machine cards for each occasion when tabulation was required, or, as an alternative, to maintain an up-to-date complete set of machine cards with, in that case, provision for linking the two sets of cards. No scheme of tabulations is given in the Report but it could not fail to be extensive; it would indeed have to be extensive to warrant the continuance of an index of such size for purely statistical purposes.

10. Size presents problems of handling of its own. The project involves the continuous maintenance of at least a reasonably accurate index of, ultimately, some ten million families, comprising the great bulk of the population. Theoretically, live persons converted into inanimate cards in a card index are a more manageable and plastic field of research than they are in the unconverted state; at any time they are available, so it might be supposed, to be counted, sorted and tabulated in any order required. No public body, however—at any rate in this country—has had experience of running so vast an index for purely statistical objects, and the experience of the General Register Office in maintaining indexes for local and national registration suggests caution in relying upon the manageability of such an index for statistical purposes.

11. An attempt is made in this paragraph to appraise the additional cost and the workability (in terms of accuracy) of a Family Index. Reference is also made to legislative needs.

(*a*) *Cost* would be considerable, if only because the Index would ultimately cover practically the whole population. As already indicated in paragraph 3 above the assumption is that it would be additional to, and not in substitution for, other sources of fertility statistics. When built up to full size in about 30 years it would be likely to contain some ten million family cards (containing on each details of husband and wife and all offspring), to which perhaps 370,000 cards would be added annually for new marriages and from which a corresponding number would be removed on termination of marriage. In addition, cards would have to be noted for perhaps up to 700,000 legitimate births annually and for the deaths and marriages of the children of subsisting marriages (say 600,000 persons) and for emigrants and immigrants if the particulars could be obtained. The cost must assume expenditure on

(i) *Manpower*. Rough estimates (based on the outline of possible arrangements sketched above) indicate that a minimum of about 60 clerks might be needed, when the Index was in full operation, for the routine work of compiling the Index; this is apart from any checking of information and before any statistical use is made of the Index. The number does not include supervisory and ancillary staff nor any staff to deal with the considerable amount of correspondence which is bound to arise in attempting to ensure the accuracy of the information in the Index. Allowing for these needs, it would be unsafe to assume that the ultimate staff required to maintain the

Index would be less than 100, the cost of which, at present rates, would be of the order of £35,000 per year. In addition, there would be the staff for the statistical operations—card punching, machine tabulations, skilled appraisal of the figures—and publication of the results. In the absence of a scheme of tabulations it is not possible to make an estimate of the statistical staff required, but it would seem *prima facie* unsafe to assume that its cost, taking one year with another, would be less than the cost of staff for maintenance (viz:—£35,000).

(ii) *Accommodation.* The sheer bulk of such an Index would make a heavy demand for space. There would ultimately be some ten million live cards; experience of large indexes at the Central National Registration Office at Southport suggests that the Family Index might need some 15,000 square feet to house the punched cards, machine installation and statistical staff. The annual cost of such accommodation, including services, might amount, at present prices, to, say, £10,000 in the provinces or £15,000 in London.

(iii) *Material, Machinery, etc.* Allowances must be made for index cards, machine cards and a considerable amount of paper. A machine installation would be required. It is doubtful whether any saving could be made on the present fertility analyses of current births, which would be still required. (The Family Index would not include illegitimate births. In any case it would be both more certain and speedier to produce current tabulations of births direct from the Birth Forms 309, filled up by a Registrar for statistical purposes under the Act of 1938, while the material was still separate and before transfer to the Index cards.) It would not seem safe to put these expenses at less than 10 per cent. of (i) above i.e. 10 per cent. of £70,000 = £7,000.

(iv) *Total Annual Cost.* The cost under headings (i) to (iii) above might therefore be of the order of £87,000 per annum.

(v) *Total Staff.* The total staff for maintenance and statistical work might, on average and taking one year with another, amount to about 200.

(*b*) *Accuracy.* The Index would neither contain all the families in the country nor would it be likely to be a completely accurate record of the undoubtedly very large sample of families which would be contained within it. Even this very large sample would not represent an exact cross-section of the country's families and their composition for the following reasons:—

(i) *Number of Families.* There could be a card for every marriage contracted in England or Wales, since the Index would be directly based on registration data. But not all married people in the country at any one time would be included, because of the effects of migration; there would be cards existing for some people who had since left the country but, on the other hand, no cards for some of those who were married outside the country and had since taken up residence within it.

(ii) *Births.* There would be a fraction (which might be large) that could not be linked with Index cards either because cards did not so far exist (since, e.g., the parents were not legally married, or were married abroad) or because cards could not be found (by reason of incorrect particulars being given at registration). It would be quite impossible to distinguish the reason for non-linkage on the information

received, and therefore any attempt to avoid this difficulty by creating supplementary cards would lead to inflation of the number of families by creating cards either for unmarried couples or for marriages for which a card already existed. There would also be births to families normally resident in England and Wales which would not be notified because they occurred abroad.

Note. Failure to note births for which a family card could not be found but in fact existed might easily cause a 2 or 3 per cent. error in the size of families and might in its cumulative effect so seriously impair the value of the Index as to make it quite unreliable for statistical purposes and more particularly for projections.

(iii) *Divorces.* There should be no failure to note the appropriate card where divorces dissolve marriages contracted in England or Wales. Some marriages are dissolved by divorces granted elsewhere; these divorces would probably not be recorded on the Index card, but they are unlikely to amount to a large proportion of the whole.

(iv) *Deaths.* The death of either spouse is to be noted, as ending the marriage. There would be many cases where the family card could not be identified and noted because of inaccurate or inconclusive information: for example, how often can a person (sometimes not a close relative or even a distant relative), when giving information as to the death of a married person, state accurately the date and place of the marriage and the wife's maiden name? Even children of the marriage find the greatest difficulty in stating date and place of their parents' marriage.

(v) *Deaths of Children.* If deaths of children are to be noted, the extent of failure to link up with the Index might be much the same as in the case of death of either spouse.

(vi) *Emigration.* There would be a growing error due to the failure to note the loss of women by emigration.

Note.—The above errors and omissions are of two sorts: first, those where the event is known to exist but cannot be assigned, as with births or deaths where the card cannot be traced. This may be due to the informant being unable to give the required information; even a surviving spouse does not always give the date of the marriage accurately, and any other informant is likely to be mistaken over names as well. Changes of name are also likely to cause a failure to identify the card. In these cases the number of unidentified events is at least known and some attempt might therefore be made statistically to make allowance for the growing inaccuracy under this head. The second sort of inaccuracy is due to events which are not recorded in this country, e.g. births, deaths and marriages abroad affecting families normally resident in England or Wales or migration which escapes notice. The extent of such inaccuracies cannot even be estimated without some external corrective such as a family census, though some correction as the result of correspondence might be possible in some cases.

(*c*) *Legislative needs.* Continuance of the Population (Statistics) Act, 1938, which is due to expire on 31st December, 1948, would be necessary, as the information concerning date of marriage, on which the Index would partly depend for the identification of the family cards, is obtained under this Act. Certain additional questions would also be necessary, e.g., at birth registrations, place of marriage of parents. So also, on death registration, it would be necessary to ask the date and place of

marriage in all cases (i.e., for the husband as well as the wife) and the wife's maiden name in order that the family card could be found and noted. If the deaths of children were to be noted, it could only be done if the date and place of the parents' marriage and mother's maiden name were ascertained at the registration of every death of a child. It seems questionable whether public opinion would tolerate this. As already indicated, on re-marriage of any woman it would be necessary for the clergyman or other registering officer to ascertain and state on a separate form when, where, and to whom she had previously been married and to set out particulars of the children of the previous marriage or marriages. Here again questions of public policy and public opinion arise. Convincing reasons would have to be shown as to the public need for such information before Parliament could be expected to approve legislation imposing on, e.g., a clergyman the obligation to ask the questions, and on, e.g., a bride the obligation to answer them.

Note. Substantial continuance of the 1938 Act will be necessary in any case if the present fertility analyses are to be continued either on the same scale as at present or in somewhat greater detail as recommended by the Report.

(*d*) *The time factor.* To produce detailed tabulations from an index of this vast size would be a complex task. Unless a large apparatus were employed, there would inevitably be a delay in the production of figures. If extensive tabulations were required, it would become difficult to fit the tabulations in with the normal operations required for maintenance. (The latter consideration applies also to a sample census.)

12. *Possible ways of increasing the accuracy of the Index.* We have seen above that the Index would fail to give a true picture for several reasons, one of which is that the effects of migration would lead to the increasing inaccuracy of the Index unless some corrective action were taken.

Migration. New entrants to the country come within the orbit of National Registration and the National Health Service, and also, in most cases, of the National Insurance system. It is conceivable that, given the necessary legislation, contact of the immigrant with one or other of these systems would enable the necessary particulars to be obtained and a decision to be made in each case of immigration whether a new family card should be opened or an existing card noted.

Emigration presents the greater difficulty, and the Committee do not insist on its noting. But unless this were done there would be growing inflation of the number of families. The composition of most of these families according to the Index would in any case be inaccurate by reason of unnoted births subsequent to emigration. There would thus be two kinds of inaccuracy. There is at present no sure means of securing information about emigrant families; the Board of Trade passenger lists do not contain sufficient information to enable families to be identified with certainty and such record of permanent emigrants as is attempted is limited to persons whose destinations are outside Europe; National Registration might help here, because it seeks to identify persons who intend to be away for more than three months, but further particulars than can at present be required would have to be given by the emigrant woman to enable her card to be found in the Family Index.

Note. The error due to migration in a Family Index is necessarily cumulative and is not susceptible of annual statistical adjustment in the same way as statistics based on census and current registration data.

Family Census as a check. The Committee in paragraph 18 suggest that the function of a Family Census would change if a Family Index were instituted and it would operate as a check on the accuracy of the Index.

If this means that family particulars in all census schedules should be compared with the appropriate family card (at least 10 million) and attempts made to resolve discrepancies, it can be said at once that the magnitude and complexity of the task would rule it out of practical consideration.

Even a statistical check restricted, as the Committee possibly intended, to the provision of figures by which the accuracy of various features of the Index could be measured would involve complete fertility analyses both of the Index material and of the census record and would be hardly less onerous.

13. *Possible assistance from National Registration.* National Registration provides a unique identity number for every individual in the country. With a view to making linkage easier the Family Index cards might be transcribed from the marriage certificate by the National Registration Officer when the newly married wife exchanged her identity card for a new one in her married name. There would be some advantages in this—

(*a*) The work of writing up the cards would be saved at the General Register Office, at a cost of a slight increase in local National Registration Offices and a slight slowing up in the procedure for issuing the new identity cards;

(*b*) The Family Index cards would include the wife's National Registration number. This would make it easier to identify her Family Index card on death or emigration.

Similar advantages would accrue in respect of the husband if his identity number could be obtained (as in most cases no doubt it could) when the wife changed her identity card. Moreover, if the mother's or father's identity card were produced when the birth of a child was registered, it would be easier to identify the appropriate family card, provided this was already included in the Index. But there are certain difficulties here, even assuming continuance of National Registration in its present form. For example:—

(*a*) It would not follow that there would be a family card for every marriage. Some women continue to use identity card and ration book in their maiden name and others adopt their new name before marriage.

(*b*) If the wife's identity number were to be the linkage factor it would have to be available on recording any family event relevant to the index. This could not be required without legislation.

14. *Statistical usefulness of a Family Index.* The Committee suggest that a Family Index would have considerable advantages for statistical analysis over the traditional methods based on registration and census data.

(*a*) It is claimed that the estimation of related populations would be made much easier. It is not understood what is in mind here unless it be the machine analysis and tabulation of the whole 10 million Index—an operation equivalent to a full census fertility analysis.

(*b*) A family census could in effect be made at any time, without asking any questions of the public. This is undoubtedly true. But it would be a major operation, even on a sample basis.

(*c*) The Family Index, the Committee suggest in paragraph 17, would harmonise registration and census data automatically and difficulties over e.g. occupational analysis would be avoided. This assumes that all the formidable physical obstacles to accurate linkage referred to above

would be overcome. Moreover, the Family Index would only give the latest answer to the same question in the different contexts (i.e. marriage, birth of children, completion of census schedules). Of itself it would do nothing to "correct" any earlier tables derived from the Index. The differing answers might have been accurate in their context and to that extent a harmonised picture would be false. Thus a man may be moving up or down the social scale in the intervals between coming in contact with the registration system and hence with the Family Index. The answers must in general be accepted as valid: there cannot be any system of checking the statements as recorded.

(*d*) Interval between births of children (spacing) is not at present studied, and is not available under the Population (Statistics) Act, but would be apparent from the Index. But the permutations and combinations of spacing would be very complicated and difficult to appraise. If spacing details were obtained at periodical censuses (i.e. by asking married persons the dates of birth of their children), the changes in spacing between one census and another might well provide a sufficient guide to the trend of family pattern in this respect.

PART II.—FAMILY CENSUS AS AN ALTERNATIVE TO FAMILY INDEX

15. The alternative method put forward by the Committee is the investigation of family pattern by means of a family census the results of which would be corrected periodically by intercensal estimates based mainly on registration data.

(*a*) The Family Census would provide basic figures for the relevant populations by sex, age, marital status.

(*b*) It would similarly provide basic figures of family groups by number of children and duration of marriage.

(*c*) Intercensal estimates of relevant populations would be made by applying the information from marriage and death registrations, divorce data, with appropriate allowances for migration, to the basic figures provided at (*a*).

(*d*) Intercensal estimates of families by size could be provided, with possible sub-division classifying each size either by age of mother or by duration of marriage; the quality of such estimates would depend upon the degree of completeness with which particulars were recorded in respect of divorces, widowhoods, deaths and migration. The increased complexity of three dimensional estimates identifying size of family, age of mother and marriage duration in combination would render their production less practicable and their validity in any event would be much diminished owing to the inevitably large margin of error that would attach to them.

(*e*) Analysis of family spacing could not be brought within any estimation procedure. In so far as such statistics were regarded as indispensable, they would have to be reserved for census occasions.

(*f*) Fertility analyses involving occupation could be made from the Family Census. They could also be made from the information given at birth registration, though that information is not so reliable.

16. *Additional Requirements for alternative scheme*

(*a*) *Legislation.* Continuance of the Population (Statistics) Act, 1938, would be required, as the basis for fertility analyses. With the present attention paid to population problems, and with ten years' experience of

the relatively smooth working of the Act in its present form, there should be no great difficulty about its continuance, but any proposals to ask extra questions may be expected to raise opposition or at least to require full justification in a form intelligible to the layman. The additional questions recommended by the Committee (summarised in paragraph 15 of the Appendix to their Report) are as follows:—

(i) Number of live births to the mother (as distinct from "living, stillborn and dead children", as at present asked). (ii) Whether mother married more than once (i.e., as distinct from whether she had any children by a previous husband, which is asked at present)	at birth registration.
(iii) Date of the marriage in all cases (i.e., for husband as well as wife, instead of for wife only as at present) (iv) Number of liveborn children of the marriage. (At present, the question whether deceased had *any* children is asked in respect of a deceased *wife*) (v) Whether deceased wife married more than once. (This would be an entirely new question.)	at death registration.

(*b*) *Divorce Data.* The Committee recommend that certain additional divorce information should be made available and published (summarised in paragraph 14 of the Appendix). The General Register Office is in touch with the Divorce Registry and hopes to arrange for this to be done.

(*c*) *Family Census.* The Committee express the hope that a family census will be taken from time to time in association with the general census. The Registrar General agrees in principle, but he would not wish to commit himself as to choice of dates and intervals until he has had an opportunity to consider the results of the sample family census taken by the Royal Commission at the beginning of 1946.

Part III.—General Conclusions on the Family Index and Alternative Methods

17. (*a*) At first sight there are attractions in the idea of a Family Index, but such examination as has been practicable shows that it is likely to be a cumbersome, difficult, expensive and uncertain instrument.

(*b*) A Family Index would be an additional burden. No present processes could be eliminated, either of registration, statistical tabulation or family census.

(*c*) A family *census* would seem to be the best means of providing a basic picture of family pattern.

(*d*) If a Family Index were brought into being gradually, years would elapse before it comprised a useful section of the population.

(*e*) Even when at full size, a Family Index would not give an accurate picture of the population of England and Wales, but would give a variable and uncertain cross-section adulterated by the inclusion of many families which had left the country and imperfect, as regards the families included, by reasons of failures of linkage.

(*f*) The accumulating inadequacies of a Family Index at all stages would make precise interpretation of its material difficult.

(*g*) The alternative scheme suggested by the Committee would appear to afford the great bulk of the information that a Family Index would give. The only apparent deficiency is that it would not provide a continuous study of spacing (i.e. intervals between children): it has been suggested above that a sufficiently frequent study of spacing would be afforded by periodical family censuses.

(*h*) Continuance of the Population (Statistics) Act is required in either event, probably with provision for some additional questions.

PART IV.—SOME OTHER MATTERS DEALT WITH BY THE COMMITTEE

18. *Occupational Analysis.* It is proposed to undertake a certain amount of analysis of births by occupation of father in the years round about the next general census (due in 1951). If there should be a family census taken with the next general census, occupational differences in family size should be able to be derived from it.

Further consideration will be given to the question of occupational analysis of marriages.

The classification of occupations used for the last census in 1931 is being revised. A review of the 5 social classes and their content will also be made.

Age at marriage. As regards accuracy of statements of age made at marriage, some enquiry is being made and the results, if in time before the Commission report, will be communicated to them. The possibility of a similar study of statements affecting duration of marriage is being considered.

19. *Statistics for Great Britain as a whole.* The Registrar General proposes to discuss with his Scottish colleague the suggestion of the Committee that the publication of some further combined tables (over and above those published in the Annual Abstract and the Monthly Digest of Statistics) might be considered.

III. FURTHER NOTE BY THE STATISTICS COMMITTEE

1. In our Report on the Statistics Required for the Analysis of Fertility we referred to a proposal for the establishment of a Central Family Index, and recommended " that the possibility of establishing such an Index and of setting up the necessary organisation for the analysis and interpretation of the material thus provided should be examined as a matter of urgency by the responsible authorities ". In order that such an examination should take place we sent to the Registrar General for England and Wales a copy of the Report with a request that we should be furnished with his comments on the cost and administrative workability of the proposed Family Index. The Registrar General has now furnished his comments on this proposal (along with comments on certain other matters traversed in our original report). We are grateful to the Registrar General for the careful examination to which, as his memorandum makes clear, the proposals have been submitted by his Department. We have now reconsidered them in the light of his comments and of certain additional information which has become available to us since the date of the report. For reasons described in subsequent paragraphs of this note, we have now come to the conclusion that we do not wish to recommend the immediate institution in this country of a Family Index on the lines proposed.

2. This conclusion is not based on the view that the Family Index would be too expensive. We have not attempted to scrutinise in detail the Registrar General's estimate that the annual cost would be about £87,000. Accepting this figure for the purpose of argument, it seems to us that such an expenditure could not be called extravagant if the Family Index were really successful. A comparison with the sums which might easily be spent on policies designed to influence the size of the population suffices, in our view, to put this point beyond doubt.

3. The valid objections to the Family Index seem to us to be those arising under the head of " administrative workability ". When we originally put forward this proposal for examination, it was in the hope that the Family Index could be established and maintained without involving any important change in present arrangements apart from the setting up of a new department inside the General Register Office. In other words, it was hoped that information already collected from members of the public was substantially sufficient to enable the Index to be adequately maintained. In his memorandum, the Registrar General has emphasised that the matching up of different registrations affecting the same family would be extremely difficult to achieve with a sufficient degree of accuracy and completeness, if no further information was obtained than at present. He has pointed cogently to the multitude of difficulties which would arise from forgetfulness, similarity of name, and changes of name and of address. We understand also that experience in other countries of attempting to match up information about the same individual from different sources on the basis of name and address only has shown this to be a most unsatisfactory method. It seems clear that the desired aim could only be satisfactorily achieved if a serial number was somehow attached to each person, or to each family, and if it could be effectively stipulated that this number should be produced at every relevant registration of birth or other relevant event. This would be possible, if, for example, we had in this country the system which now exists in France of the " Family Book ", which is opened on the occasion of each marriage and which has to be produced when the births

of children are registered.(1) Even with some such system as this, matching up might still present some difficulties, but it does not seem that these would be insuperable once people in general were fully habituated to the system. The introduction, however, of any such system into this country would be a considerable innovation, which would provoke opposition which might be widespread and in some quarters would certainly be fanatical. Since in fact the innovation would cause no real hardship to anyone, we would not hesitate to recommend it if it were the case that there was no other possible way of obtaining reasonably adequate statistical information about family size. But this, as we admit below, is not the case.

4. A further difficulty arises from migration. We recognised in our original Report that under the existing arrangements for obtaining information, migration would create certain difficulties for the administration and use of the family index. In the light of the Registrar General's comments, it appears that we may not have allowed sufficient weight to these difficulties. It seems probable that if we knew no more about migrants than we do at present, the Family Index would fairly quickly become seriously deficient as a guide to the family history of the population of the country The only way in which this could be prevented would be to obtain the necessary information from persons emigrating or immigrating. This would necessarily involve asking more questions of persons leaving or entering the country; if the Family Book system were in force it would be necessary to ask married emigrants the number of their book, and to issue a new book to married immigrants. For the streams of migration which in fact constitute much the greater portion numerically, it ought to be possible to obtain the necessary information and again in our view the innovation would be one which would cause no real hardship—so long as it is recognised that for some migrants (e.g. those who leave or enter on cross-channel steamers amongst far greater numbers of people merely going on holiday) the necessary information could not in practice be obtained.

5. It thus appears that to enable a Family Index to work successfully would require much more than merely establishing a new branch in the General Register Office. It would involve considerable changes in the system of registration and in the recording of migration. Such changes would in our view be clearly justifiable if there were no other way of obtaining information about the movement of family size. In fact, however, there is the alternative proposed in paragraphs 10–12 of our original Report, namely the combination of regular family censuses with suitably arranged statistics of birth registration. There is good reason to believe that a great deal could be done by the fuller exploitation of these sources of information, which indeed have so far enjoyed only the beginnings of their development as sources of statistical data about the trends of family size. We are glad to know that the Registrar General shares our view of the possibilities of this technique and hope we may assume that the statistical work of his Department will be developed along these lines. In these circumstances we think the right course is to pigeon-hole the idea of a Family Index and to concentrate on the full development of this alternative system. We should like to stress that for this purpose it would be necessary that the family censuses should take place (*a*) regularly and (*b*) at not too infrequent intervals: we would recommend that they should be taken every 10 years.

(1) The French Family Book is not, in fact, used for statistical purposes; we refer to it only as an example of the kind of mechanism by which a Family Index *could* be made to function successfully.

6. It may well be the case that development along these lines will meet the needs of the community for statistical analysis of family size for many years, or even indefinitely. On the other hand, it is conceivable that a time might come when it was felt to be necessary to have information about the building up of families which was more accurate, complete and detailed than this method could provide. In this case, the establishment of an effective Family Index would commend itself, and in the circumstances supposed public opinion should be willing to permit the changes which would be required for the Index to function successfully.

Standardised Reproduction Rates, 1938-42

NOTE BY THE GOVERNMENT ACTUARY'S DEPARTMENT

1. The violent fluctuations that have occurred in the marriage rate in England and Wales in recent years render crude birth and reproduction rates suspect as standards of comparison and indications of population trend. It appears to be the case, for example, that the relative stability of the crude birth rate in the years 1934 to 1938 was due to the rapid increase in the numbers of young married women, on account of the rise in the marriage rate that commenced in 1933, approximately counter-balancing a continuing fall in the issue rate per married woman. Roughly 95 per cent. of women's fertility is legitimate, and it is found that married women's fertility is governed not only by age but to an even greater degree by duration of marriage. It was thought therefore that it would be useful if a standard distribution of married women under age 45 by age and duration could be constructed to which fertility rates could be applied as a rough method of standardising the overall rate.

2. For the year 1938 computed maternity rates for England and Wales, by age of mother and duration of marriage, were supplied to the Committee by the General Register Office. They were derived from the statistics supplied on the registration of live and still births under the Population (Statistics) Act and estimated distributions of married women by age and duration of marriage, during those years. These rates, showing wide variations from year to year, and obviously affected by the abnormal durational distribution of marriages due to heavy war and immediate pre-war marriage rates, seemed to offer a good example for the application of this method of standardisation.

3. The construction and features of the standard distribution of married women by age and duration constructed for this purpose on the basis of 1938–39 mortality and 1938 marriages is described in the Appendix to this Note. The result of applying to that distribution the "select" maternity rates of the years 1938 to 1942, and combining the births so obtained with illegitimate births based on the fertility rates for those years, is to produce the following standardised gross reproduction rates to which the corresponding rates as ordinarily computed are added for comparison:—

GROSS REPRODUCTION RATES

Year	Standardised	Ratio to 1938 rate	"Crude"	Ratio to 1938
1938	·954	—	·897	—
1939	·914	·958	·892	·994
1940	·835	·875	·850	·948
1941 .. .	·792	·830	·836	·932
1942	·873	·915	·934	1 041

4. It will be seen that the stabilisation of the distribution of married women has the effect of more than doubling the apparent fall in the "crude" gross reproduction rates between 1938 and 1941 and of converting an increase of 4 per cent. over 1938 in the 1942 rate into a decrease of 8½ per cent. The

standardised rates give a more accurate measure of the implicit trend of fertility, which is masked in the "crude" reproduction rates by the presence of an abnormal number of married women at the ages and durations of marriage when fertility is at its maximum.

5. The fact that the standardised gross reproduction rate in 1938 is some 6 per cent. higher than the "crude" rate may cause some surprise. The explanation is that, as may be seen from the figures in Table II in the Appendix to this Note, the 1938 marriage rates result in ultimate proportions of married women some 10 per cent. in excess of those actually in existence in 1938. The births to be produced by this excess in the number of married women (which occurs mainly at the later ages and durations of marriage) have to be added to those actually occurring in the year and these account for the excess in the standardised rate.

6. It may be of interest to set out the net reproduction rates corresponding to the above gross rates. In a standardised function the use of varying mortality rates would be inappropriate, so the 1938–39 mortality experience has been adopted. This makes the rates not strictly comparable with the effective reproduction rates computed by the General Register Office, but the differences introduced by forecasting are not large; the effective rates have therefore been added below.

Year	Standardised Net Reproduction Rate	"Crude" Effective Reproduction Rate
1938	·860	·810
1939	·824	·808
1940	·752	·772
1941	·713	·761
1942	·785	·853

7. The extent to which births fall short of full reproduction is seen to be increased by standardisation in each year since 1940, and by 1942 to be a deficit of over 20 per cent. With 10 per cent. fewer women marrying than is assumed in the standard distribution the deficit would be nearly 30 per cent.

8. Detailed statistics for 1943 are not yet available, but an approximation to the standardised rates obtained by an examination of the information available suggests that the comparison for 1943 would be as follows:

	Standardised	*"Crude"*
Gross Reproduction Rate ...	·915	·985
Net Reproduction Rate... ...	·825	·903 (effective)

Thus, instead of the gross reproduction rate in 1943 approaching unity, it should really be regarded as having fallen nearly 10 per cent. short of that standard, and instead of the population being within 10 per cent. of reproducing itself, there is a shortage of nearly twice that proportion. With 10 per cent. fewer women marrying than is assumed in the standard distribution the shortage would be about 25 per cent.

December, 1944.

APPENDIX

A STANDARD DISTRIBUTION OF MARRIED WOMEN BY AGE AND DURATION OF MARRIAGE

1. A distribution of married women, by age and duration of marriage, was required for the purpose of standardising fertility rates in various years. By applying to such a distribution fertility or issue rates for married women, analysed by age and duration, the aggregate effect of fertility may be compared one year with another, free of the disturbing effect of sharp changes in marriage rates or marriage ages.

2. It seemed desirable that the distribution should reflect modern conditions so far as possible, and for that reason the mortality rates of the two most recent years which were virtually unaffected by war conditions (1938 and 1939) and the marriage rates of the last complete pre-war year (1938) were adopted as the basis. The use of the marriage rates of the year 1938 might perhaps be criticised on the ground that it was a year of high marriage rates, but in reply to this it may be pointed out that it followed three or four years in which marriages were at a similar level: it can hardly be said, therefore, that it includes a large number of marriages that were suspended during the economic slump of 1930–32. The more reasonable view would seem to be that it exhibits the rather higher level of marriage rates that modern economic conditions are making possible, and thus a distribution of married women based on such marriage rates provides the means for measuring the ultimate reproduction rate to which the rates based on the present abnormal distribution of married women are tending.

3. In order to obtain a life-table distribution of married women by age and duration based on say 10,000 girls at age 16, it is necessary to allow not only for the marriage of a spinster and for her death as a married woman, but also for the death of her husband, and for her remarriage when a widow. Married women's mortality has been assumed to bear the same ratios to all women's mortality as were found to exist in 1930–32 (see Report on English Life Table, No. 10, p. 50). Husbands have been assumed to be distributed in relation to wives in the age proportions at marriage occurring in 1938, and a series of joint survival factors were constructed, allowing for husbands' mortality on the basis of 1938–39 experience and married women's mortality as above. The relatively small proportion of all marriages that relate to widows has been allowed for by increasing the marriages of spinsters by the ratio of widows' to spinsters' marriages that occurred in 1939.

4. The results are given in Table I, in which the figures are shown for individual years of marriage up to the tenth but are otherwise grouped quinquennially. The Registrar General's estimates of married women for recent years did not permit the work to be carried beyond age 45, but this limitation is not important for the object in view.

5. For purposes of record, the numbers of married and of other women in each age group of the standard distribution are given in Table II, together with the corresponding proportions married and, for comparison, the proportions married in 1938.

TABLE 1

Stationary population of married women under age 45, by age attained and duration of marriage, if 10,000 girls attain age 1[illegible] each year and experience mortality at the rates of the years 1938 and 1939 and marriage at the rates of the year 1938: England and Wales.

Age attained (last birthday)	Duration of marriage in years:—													
	0–1	1–2	2–3	3–4	4–5	5–6	6–7	7–8	8–9	9–10	10–15	15–20	20 and over	Total
Under 20	840	357	104	5	—	—	—	—	—	—	—	—	—	1,306
20–24	4,509	4,089	3,348	2,456	1,545	820	350	101	5	—	—	—	—	17,223
25–29	2,458	3,057	3,655	4,148	4,439	4,410	3,998	3,278	2,405	1,511	1,247	—	—	34,606
30–34	676	863	1,115	1,450	1,882	2,402	2,986	3,578	4,055	4,340	15,208	1,212	—	39,767
35–39	264	300	355	426	523	655	839	1,084	1,413	1,832	16,842	14,685	1,165	40,383
40–44	152	162	179	198	221	249	288	339	409	502	5,601	16,122	15,070	39,492
Total	8,899	8,828	8,756	8,683	8,610	8,536	8,461	8,380	8,287	8,185	38,898	32,019	16,235	172,777

TABLE II

Numbers of married and other women in standard distribution, and proportions married, in age groups

Age attained (last birthday)	Numbers of			Proportions Married	
	Married Women	Other Women	Total Women	Standard distribution	Estimated 1938
15–19	1,306	48,611	49,917	·026	·023
20–24	17,223	32,213	49,436	·348	·322
25–29	34,606	14,251	48,857	·708	640
30–34	39,767	8,488	48,255	824	733
35–39	40,383	7,212	47,595	848	·771
40–44	39,492	7,295	46,787	·844	·768
Total 15–44 ..	172,777	118,070	290,847	—	—

Mortality in Great Britain
A Hypothetical Life Table for 1942-1944

MEMORANDUM BY THE GOVERNMENT ACTUARY'S DEPARTMENT

1. The Life Table appended to this Memorandum was compiled by the Government Actuary's Department to meet the request by the Statistics Committee for an up-to-date indication of mortality experience in Great Britain. It was thought that for this purpose it would be better to make a special study of the subject than to have recourse to the death-rates which had been used a year or two earlier in connection with the estimates of emerging expenditure and income under the National Insurance Bill of 1946; and it was decided to attempt an estimate of the mortality which would have been experienced in Great Britain in the three years 1942–44 if there had been no war

2. The Table is essentially hypothetical in character. For this reason, and because it relates to the whole of Great Britain, it cannot be regarded as a member of the series of National Life Tables for England and Wales and for Scotland respectively which have been derived from the enumeration of the population at each census and the records of deaths in the years adjacent to the census. The National Life Tables are constructed entirely on the basis of ascertained facts, to which they adhere closely. In the present instance, so far as the numerator of the mortality rate is concerned, the recorded deaths of the period could provide only a starting point instead of the entire foundation; while as regards the denominator—the population at risk—the annual mid-year estimates of the Registrars General had to serve as a substitute for an actual enumeration. In time of peace these estimates are obtained by adjusting the latest Census figures for each age-group to allow for movements in the intervening period as derived from the records of births, deaths and migration; and although the figures so obtained provide a good enough basis for ordinary inter-censal calculations they would not in normal circumstances be regarded as an adequate substitute for an actual enumeration of the population by age for the purposes of a national life table.

3. The introduction of national registration in 1939 provided a new source of material for the revision of the annual estimates based on the 1931 Census; but this circumstance cannot be regarded as full compensation for the suspension of the full-scale census which, but for the war, would presumably have been taken in 1941. In using the annual population estimates for the years 1942–44 as a basis for the life table described in this note, a particular difficulty arose in that these estimates do not subdivide the population aged 85 and over into quinary age-groups. Further reference is made to this point in a later paragraph.

4. The methods employed in the construction of the more recent members of the series of National Life Tables for England and Wales and for Scotland have been fully described in the publications of the Registrars General (see, for example, Part 1 of the Registrar General's Decennial Supplement (England and Wales) 1931, which contains English Life Table No. 10). The construction of the 1942–44 table, for which the statistical data for the two countries were aggregated, followed the same general lines so far as the special circumstances would allow. For ages up to 5, values of the rate of mortality were obtained

from a detailed analysis of the births and deaths at individual ages; and for ages over 5 the customary methods—derivation of pivotal values at quinary age-points followed by osculatory interpolation for the intervening ages—were retained in principle, civilian deaths directly due to enemy action being excluded throughout. Special devices had, however, to be employed to deal with the two major points of difficulty:—

(1) the substitution of a hypothetical "normal" mortality experience for that actually sustained by a population which was subject to special civilian risks and from which very large numbers of persons had been withdrawn for military service;

(2) the derivation of age-specific mortality rates above age 85 in the absence of any information as to the actual numbers of persons living at individual ages, or in quinary age-groups, beyond that point.

5. As regards (1), the first step was to examine, age-group by age-group, the numbers of men and women in the Forces during 1942–44 in relation to the numbers in civil life, and to obtain a "normal" population for each sex by adding the two sets of figures together. On the obvious hypothesis that persons in the Forces were healthier lives than those in civil life, an upper limit for the "normal" death-rate for each sex in each age-group was obtained by dividing the civilian deaths by the civilian population; a lower limit was obtained by dividing the civilian deaths by the total population.

6. In the case of women, the difference between the upper and lower limits was small because, over the three years in question, the numbers in the Forces fell almost entirely in the four quinary age-groups 15–19, 20–24, 25–29 and 30–34, and represented (in round figures) no more than 4, 12, 3 and 1 per cent respectively of the total female population in those age-groups. For the purpose of constructing the life table the arbitrary assumption was made that in the normal circumstances of civilian life the death rates experienced by the Forces personnel would have been about half the rates actually experienced in 1942–44 by the civilian population at the same ages. It will be seen from the percentages quoted above that only in one age-group (20–24) can this assumption involve any substantial margin of error. The quinary pivotal central death-rates obtained on this basis were used, in conjunction with those obtained in the usual manner for the older age-groups, as a framework from which rates at individual ages were obtained by osculatory interpolation.

7. In the case of men the problem was more difficult. The number of men in the Forces was about ten times the number of women and was spread over a larger number of age-groups. In some of these the difference between the upper and lower limits of the "normal" death-rate was therefore very considerable. The best method of obtaining a suitable interpolation between the two limits appeared to be by way of a study of the trend of the ratio of male mortality to female mortality in the years immediately preceding the war. This is a factor which, in any one age-group, does not fluctuate violently between one year and another, and it was not difficult to estimate, within fairly narrow limits, what the ratio would have been in 1942–44 under normal conditions. As "normal" female death-rates had already been chosen which could not be very wide of the mark, limiting values for the "normal" male death-rate in each military age-group were obtained by applying to these the upper and lower limits chosen for the male/female mortality ratio. By this method the range of choice was restricted to an extent comparable to that within which the female rates had to be chosen; and suitable rates for use in constructing the life table were then obtained by reference to the secular trend of the male death-rates at the age-groups affected. Although the rates so

obtained are necessarily more speculative than those for women, it seems unlikely, in view of the fairly stable nature of the trends on which the estimates were based, that they can be very wide of the mark.

8. The second problem referred to in paragraph 4 also had to be dealt with on an *ad hoc* basis. For the mortality rates of each sex in extreme old age the possibility of breaking down the total deaths at ages 85 and over and the estimated population aged 85 and over into quinary groups was considered. Over the period 1932 to 1942 (the latest year for which the Registrar General's Annual Review figures for England and Wales were then available) the age-distribution of deaths at ages 85 and over was found to have remained fairly stable, so that no difficulty arose in fixing a reasonable distribution for allocating the deaths at ages 85 and over in 1942–44 into quinary age-groups. In view, however, of the length of time which had elapsed since the population was enumerated by age, there appeared to be no method by which estimates for the denominators of quinary group rates could be made with any confidence. The oldest age-group for which a central death-rate could be obtained from the data by normal life table methods was 80–84, and it was decided to project the death-rate from age 82 by a Gompertz formula, as was done in English Life Table No. 10. The ratio $r = \frac{\text{colog } p_{x+5}}{\text{colog } p_x}$ required for this purpose was obtained by constructing an equation such that the value of r obtained from it would yield death-rates which, when divided into the hypothetical distribution of deaths referred to above, would produce figures for the population in quinary age-groups which would add up to the total estimated population aged 85 and over. It will not be possible to assess the margin of error involved in this process until a detailed age-enumeration of the aged population becomes available from the next census.

GREAT BRITAIN LIFE TABLE, 1942–44 : MALES

Age x	q_x	l_x	Age x	q_x	l_x
0	·05649	100,000	55	·0152	75,969
1	·00582	94,351	6	·0166	74,814
2	·00308	93,802	7	·0180	73,572
3	·00253	93,513	8	·0196	72,248
4	·00218	93,276	9	·0212	70,832
5	·00191	93,073	60	·0230	69,330
6	00168	92,895	1	·0249	67,735
7	·00148	92,739	2	·0271	66,048
8	·00130	92,602	3	·0295	64,258
9	·00115	92,482	4	·0322	62,362
10	·00105	92,376	65	·0351	60,354
1	·00100	92,279	6	·0383	58,236
2	·00102	92,187	7	0416	56,006
3	·00111	92,093	8	·0450	53,676
4	·00128	91,991	9	·0485	51,261
15	·00149	91,873	70	0524	48,775
6	·00171	91,736	1	·0567	46,219
7	·00190	91,579	2	·0618	43,598
8	·00207	91,405	3	·0680	40,904
9	·00224	91,216	4	·0750	38,123
20	·00241	91,012	75	·0828	35,264
1	·00255	90,793	6	·0912	32,344
2	·00265	90,561	7	·100	29,394
3	·00270	90,321	8	·109	26,455
4	·00272	90,077	9	·119	23,571
25	·00271	89,832	80	·130	20,766
6	·00270	89,589	1	·141	18,066
7	·00270	89,347	2	·151	15,519
8	·00272	89,106	3	·161	13,176
9	·00273	88,864	4	·171	11,055
30	·00275	88,621	85	·182	9,165
1	·00279	88,377	6	·194	7,497
2	·00285	88,130	7	·206	6,043
3	·00293	87,879	8	·219	4,798
4	00303	87,622	9	·232	3,747
35	·00316	87,357	90	·247	2,878
6	·00331	87,081	1	·262	2,167
7	·00349	86,793	2	·277	1,599
8	·00370	86,490	3	·294	1,156
9	·00394	86,170	4	·311	816
40	·00421	85,830	95	·329	562
1	·00452	85,469	6	·348	377
2	·00489	85,083	7	·367	246
3	·00531	84,667	8	·388	156
4	·00578	84,217	9	·409	95
45	·00630	83,730	100	·430	56
6	·00688	83,203	1	·453	32
7	00752	82,631	2	·476	18
8	00822	82,010	3	·499	9
9	00897	81,336	4	·523	5
50	·00979	80,606	105	·547	2
1	·0107	79,817	6	·572	1
2	·0117	78,963			
3	·0128	78,039			
4	·0139	77,040			

GREAT BRITAIN LIFE TABLE, 1942–44 : FEMALES

Age x	q^x	l_x	Age x	q_x	l_x
0	04444	100,000	55	·00927	81,312
1	00518	95,556	6	·0100	80,558
2	·00267	95,061	7	·0109	79,752
3	·00217	94,807	8	·0118	78,883
4	·00184	94,601	9	·0129	77,952
5	·00157	94,427	60	·0140	76,946
6	·00134	94,279	1	·0153	75,869
7	00113	94,153	2	·0168	74,708
8	·00096	94,047	3	·0185	73,453
9	·00086	93,957	4	·0205	72,094
10	·00081	93,876	65	·0226	70,616
1	·00081	93,800	6	·0250	69,020
2	·00085	93,724	7	·0276	67,294
3	·00095	93,644	8	·0305	65,437
4	·00110	93,555	9	·0337	63,441
15	·00130	93,452	70	·0372	61,303
6	·00149	93,331	1	·0410	59,023
7	·00166	93,192	2	0454	56,603
8	·00181	93,037	3	·0502	54,033
9	00195	92,869	4	·0555	51,321
20	·00208	92,688	75	·0614	48,473
1	·00219	92,495	6	·0678	45,497
2	·00228	92,292	7	·0747	42,412
3	·00233	92,082	8	·0823	39,244
4	·00236	91,867	9	·0906	36,014
25	·00237	91,650	80	·0996	32,751
6	·00237	91,433	1	·109	29,489
7	00238	91,216	2	·119	26,275
8	00238	90,999	3	·128	23,148
9	·00239	90,782	4	·138	20,185
30	·00239	90,565	85	·148	17,399
1	·00239	90,349	6	·159	14,824
2	·00242	90,133	7	·171	12,467
3	·00246	89,915	8	·184	10,335
4	·00251	89,694	9	·197	8,433
35	·00258	89,469	90	·212	6,772
6	·00266	89,238	1	·227	5,336
7	·00277	89,001	2	·243	4,125
8	·00289	88,754	3	·260	3,123
9	·00303	88,498	4	·278	2,311
40	·00319	88,230	95	·297	1,669
1	·00338	87,949	6	·317	1,173
2	·00360	87,652	7	·338	801
3	·00386	87,336	8	·361	530
4	·00415	86,999	9	·384	339
45	·00446	86,638	100	·408	209
6	·00481	86,252	1	·432	124
7	·00518	85,837	2	·458	70
8	·00556	85,392	3	·485	38
9	·00596	84,917	4	·512	20
50	·00640	84,411	105	·540	10
1	·00687	83,871	6	·568	5
2	·00741	83,295	7	·597	2
3	·00799	82,678	8	626	1
4	·00860	82 017			

The Course of Mortality in Great Britain

MEMORANDUM BY THE GOVERNMENT ACTUARY'S DEPARTMENT

Introductory

1. It was decided by the Statistics Committee that some investigations should be made into the course of mortality in Great Britain with a view to furnishing suitable bases for population projection. The Committee gave a general indication of the lines on which they considered that the enquiry should be made, and the Government Actuary agreed that Mr. P. R. Cox of his Department should be responsible for carrying it out. The investigations described in the following paragraphs were pursued as far as possible within the framework proposed, in order to provide some material on which a choice of alternative mortality assumptions for the projections could be made.

2. One possible basis which was suggested by the Statistics Committee was the use of the mortality of a recent period of years. A life table based on the experience of civilians in Great Britain in the years 1942–44, excluding deaths directly due to the war, was produced in the Department and is described in a separate memorandum.

Two other possible approaches to the problem of choosing suitable mortality rates for population projection were mentioned by the Committee. In the first place, attention was drawn to the continued reduction over a period of years in the death rates in most age-groups and to the probability that these reductions would continue on a similar scale in the future, except perhaps at some of the younger ages where mortality is already very low.

Secondly, reference was made to a tendency for the death rates at the older age-groups to begin to fall now that these groups are being recruited from generations of men and women who at earlier periods of life experienced lighter mortality than their predecessors and who may therefore represent progressively healthier and longer-lived stocks.

3. Before beginning to pursue either of these lines of approach it seemed desirable to study with some care the nature of the national data which are available, in order to try to use them to the best advantage without undue labour. Modern census and registration statistics, including the estimates prepared by the Registrars General of the size and age-distribution of the population in inter-censal years, may be regarded as a sufficiently accurate basis for broadly determining trends in mortality without any adjustment for possible errors and misstatements in the data; but the statistics for England and Wales and for Scotland are published separately and as a matter of working convenience it was thought desirable to consider whether the data for the larger country could legitimately be used as a broad guide to the trend of mortality in the whole of Great Britain.

Comparison of the changes in mortality rates in England and Wales and in Great Britain, 1900–32

4. The ratios shown in Table 1 indicate that the extent of the fall in the mortality of males was in fact virtually the same in the two areas at ages 25 and over, and that there was also a close similarity between the ratios for England and Wales and Great Britain at younger ages. The same features have been

observed in the female experience. It was decided, therefore, for the general purpose of determining broad trends to use the data for England and Wales alone. An exception was made in respect of the first year of life, where Scottish mortality is markedly different from that of the remainder of Britain.

TABLE 1

Comparison of the trends of male mortality in England and Wales and in Great Britain, 1900–32

Age Group	Ratio of crude group death rate in undermentioned years to that for the same area in 1900–2					
	England and Wales			Great Britain		
	1910–12	1920–22	1930–32	1910–12	1920–22	1930–32
0– 4	·703	·564	369	·717	·588	·390
5– 9	·788	·719	·564	·795	·712	·571
0–14	842	·789	·658	·843	·779	·651
15–19	·825	·814	·731	·815	·791	·702
20–24	·780	·788	·688	·773	·765	·668
25–34	·752	·691	·542	·750	·686	·537
35–44	·730	·622	·511	·729	·621	·516
45–54	·781	·631	·594	·787	633	·596
55–64	·853	·718	·678	·849	719	·673
65–74	·899	·821	·819	·899	·824	·822
75–84	·940	·912	·941	·940	920	·947
85 and over	·928	·908	·985	·927	·912	·983

5. The death rates published annually by the Registrar General for England and Wales relate to five-year age-groups below age 25 and to ten-year age-groups thereafter. Except at the youngest and oldest ages, this system of grouping is probably good enough for a broad examination of trends; indeed, it may have some advantage in tending to eliminate minor misstatements of age. In the first age-group, 0—4 years, further analysis is necessary for most purposes, and in general the mortality rates at ages less than 1 month, 1–12 months and 1–4 years have been dealt with separately in this investigation. The age-group 85 and over cannot be broken down with any accuracy during inter-censal periods and the mortality rates for this group are of limited use in formal analysis.

The course of the death rates

6. Chart I (pp. 80–4) shows in graphic form the changes in the mortality of men and women in England and Wales in certain age-groups from year to year since 1885. The data relate to civilians only in war years; civilian mortality from war causes has not been excluded. The general picture is of a consistent downward trend on which frequent short-term fluctuations are superimposed. These irregularities are generally regarded as due in the main to the incidence of epidemics and "hard" winters. It is not practicable to take account of variations of this kind when attempting to make population projections. When the experience of a series of years is averaged, such variations tend to cancel each other out and it was therefore considered that it would probably be good enough for the purposes of trend analysis to use the death rates of consecutive five-year periods. The results of some tests on this point are described in paragraph 11.

7. The actual progression of the rates shown in Chart I may well be the result of a combination of forces acting in different ways with varying intensities from time to time. Among these forces may be mentioned improvements in hygiene and sanitation, a higher level of nutrition and new medical discoveries. These factors cannot easily be studied in isolation and only a broad impression of their influence can be gathered. There is reason to hope that in such respects as these the rates of mortality will not suffer any set-back; indeed, there is still ample scope for advances in medical knowledge which might have the effect of accelerating the rate of improvement.

The future course of mortality and the level which the rate for any particular age-group may eventually reach would not seem to be conditioned to any over-riding extent by the events of the past—even the recent past—and it would be imprudent to place too much reliance on the continuance for a long time of the general trends exhibited in Chart I. If, however, no regard at all is paid to the course of past experience the problem of projection becomes a matter of speculation pure and simple.

With these considerations in mind it was thought necessary to attempt to give some kind of formal expression to the trend of mortality in each age-group over a recent series of years.

Period of investigation

8. As well as the long-term trend and the short-term fluctuations in mortality which have been described above, there may also be " waves " of an intermediate character, occasioned for example by variations in economic circumstances. If the death rates for only a few years are made the subject of examination, there is a danger that a portion of such a wave may be confused with the underlying trend. In order to eliminate this possibility it was decided to have regard in the main to the experience of a fairly long period—viz., from the beginning of the twentieth century to the present day—bearing in mind, however, the general course of the rates before 1900 and maintaining a look out for any changes in direction that may have occurred during the years under review.

General mode of determination of trend

9. It is possible to form an idea of the course of mortality in any age-group by eye and to draw a freehand curve to represent the assumed underlying trend; but this method is bound to be more or less arbitrary and, what is more important, does not provide a basis for continuing the curve for any appreciable distance into the future. It was thought preferable to apply some well-defined and consistent arithmetical method to the data for each sex in each age-group, and accordingly tests were made with various types of mathematical function in order to see which could be employed most suitably throughout to represent the trend.

After certain preliminary investigations it was decided that it would be sufficient for this purpose to work only upon the data for males in certain age-groups, and to fit to them, using the method of moments, the following curves:—

(1) straight lines;

(2) exponential curves;

(3) rectangular hyperbolas, and

(4) curves of the third degree similar in general properties to the rectangular hyperbola but more adaptable.

If t represents time and if a, b, c and d are constants in any one age-group, the corresponding expressions for the rate of mortality at time t are:—

(1) $b - at$ (2) e^{b-at}

(3) $\frac{a}{b+t}$ (4) $\frac{a}{b+ct+t^2}$

It must be emphasised that the experiment of fitting these four simple types of curve was not made under any delusion that it would be possible to derive from the experience of the last half-century a " law of mortality " which could be automatically used to obtain projections extending for an indefinite period into the future. It need hardly be remarked that if such an investigation had been considered at all feasible it would not necessarily have proceeded on the basis of functions which imply that the rate of mortality at any age will ultimately be infinitely small or, in the case of function (1), negative. The extent to which mortality rates have fallen over a relatively short period in the immediate past cannot be regarded as a crucial factor in the determination of the level to which they may ultimately fall in the future. It was considered therefore that if one or other of the simple types of function chosen for experiment could be shown to reflect recent experience fairly well, and also to yield calculated values for the rate of mortality (say) 30 or 40 years ahead which were positive in sign and " reasonable " in relation to current levels, such a function could, in the absence of any better method, be tentatively adopted as a basis for projections without violating any *a priori* considerations of principle regarding the ultimate mortality level. Some further reference is made to this question of ultimate level in paragraph 15.

10. The functions mentioned in the preceding paragraph do not incorporate any factors representing seasonal or other short-term fluctuations. Hence although, as already mentioned, the grouping of the data into five-yearly averages may be expected to eliminate these fluctuations to a considerable extent, it would not be strictly accurate to measure the " goodness of fit " of the resulting curves by tests based on the customary hypothesis that differences between the observed and calculated values were distributed in accordance with the normal curve of error. The four sets of results can, however, be compared among themselves in a general way without invoking any formal criteria of this description.

Table 2 shows for four age-groups the male death rates in each quinquennium since 1900, except at the military ages during war periods, and the extent to which the calculated values differ from them. The four groups are spread fairly widely over the span of ages, and it is reasonable to suppose that any conclusions drawn from the Table will be generally applicable to males in other age-groups and also to the mortality of females.

It cannot be said that any one of the four types of function is conspicuously more successful than the others in reproducing the data. The choice between them can therefore be made only on general grounds. The hyperbolic types (3) and (4) have a more artificial flavour than the others, and depart to a greater extent from the actual experience when they are extended backwards into the nineteenth century. It was accordingly decided to pursue the analysis by the use of the linear function (1) and the exponential function (2).

11. Table 2 does not show very clearly whether or not the exponential curve can be regarded as representing the trend, not only of the whole of 1901–45, but also of the latter part of this period. The position can more readily be comprehended from Chart I; but first it is necessarv to describe how the trend-lines shown on the Chart were fitted.

Table 2 is based on the average annual rate of mortality in five-yearly periods, but some consideration was given to the question whether this grouping had any important effect upon the determination of the trend. As the aim of the enquiry was to assist in deciding on survival factors for the purpose of projecting the population, it was also considered whether the trend in time of functions of the type $_np_x$ would differ significantly from that of the group death rates.

TABLE 2

Crude mortality rates in age-groups for males in England and Wales 1901–1945. Comparison of the differences between the observed rates and those obtained by fitting various assumed trend-curves to the data in groups of five calendar years

	1901–05	1906–10	1911–15	1916–20	1921–25	1926–30	1931–35	1936–40	1941–45	Total of deviations irrespective of sign
Age 10–14								*	*	
Actual death-rate ...	2·14	1·97	2·05	2·41	1·69	1·61	1 44	1·21	1·06	—
Deviation of calculated rate from actual rate:—										
Type (1) .. .	+·06	+ 10	−·10	− 59	—	− 05	−·01	+·10	+·12	1·13
„ (2)	+·13	+·12	−·11	−·62	− 04	−·09	− 04	+ 09	+·14	1·38
„ (3)	+·23	+ 16	−·12	−·65	− 07	−·10	−·04	+·11	+·18	1·66
„ (4) .. .	−·03	+·11	−·05	−·53	+ 04	− 03	−·02	+ 06	+·07	0·94
Age 25–34								*		
Actual death-rate ..	5·89	5 25	5·15	omitted	4·05	3 68	3 31	2·95	omitted	—
Deviation of calculated rate from actual rate:—										
Type (1) ..	−·03	+·20	−·11	—	+·17	+ 13	+·09	+·04	—	0·77
„ (2)	+·18	+·26	− 15	—	+·07	+·06	+ 09	+ 13	—	0·94
„ (3)	+·38	+ 26	−·24	—	−·02	+ 02	+·11	+ 23	—	1·26
„ (4) ..	−·31	+·23	+·04	—	+·25	+·13	+ 11	− 03	—	1·10
Age 45–54								*	*	
Actual death-rate ...	17·0	15·5	14 9	14·0	11·6	11·6	11·2	10·8	9·5	—
Deviation of calculated rate from actual rate:—										
Type (1)	−·6	+·1	−·2	−·2	+1 4	+·5	—	−·4	—	3·4
„ (2)	−·4	—	−·4	−·4	+1 1	+·3	−·1	− 4	+·2	3·3
„ (3)	—	+·2	−·4	−·5	+1 0	+·2	− 1	− 4	+ 5	3·3
„ (4) . .	−1·4	−·1	+ 1	+·2	+1·7	+·7	+·1	− 5	−·2	5·0
Age 65–74								*	*	
Actual death-rate ...	65·3	64·4	64·1	63 0	58·2	58·3	56·7	56 6	51·4	—
Deviation of calculated rate from actual rate:—										
Type (1)	+1 0	+·3	−1 1	−1·6	+1·6	−·1	−·1	−1 6	+2·0	9·4
„ (2)	+1·1	+·2	−1·3	−1·9	+1·2	−·5	−·5	−1·9	+1·8	10·4
„ (3)	+1·5	+·4	−1 1	−1·8	+1·3	− 3	−·2	−1·5	+2·3	10·4
„ (4) .. .	−·9	−·2	−·6	−·7	+2 6	+·6	+·1	−2·2	+0·6	8 5

Tables for the rapid conversion of values from one form to the other have been published by Reed and Merrell[1] and, as Table 3 shows, they were found on independent examination to give very accurate results when applied to the mortality data for England and Wales in the years 1930–32.

* Civilian mortality from war causes has been excluded.

(1) *American Journal of Hygiene*, Vol. 30, No. 2 (1939).

TABLE 4

Projected crude age-group mortality rates, England and Wales, males, obtained by the use of the straight line and exponential curve applied in various ways

Age-group	Year	Fit made directly to crude group death rates		Fit made to life table survival factors	
		Using data for quinquennial groups of years	Using data for every individual year	Using data for quinquennial groups of years	Using data for every individual year
10–14					
Using straight line	1955	0·87	0·82	0·92	0·92
	1965	0·61	0·55	0·66	0·68
	1975	0·36	0·28	0·42	0·44
Using exponential curve	1955	0·99	0·96	1·02	1·02
	1965	0·84	0·81	0·88	0·89
	1975	0·72	0·68	0·76	0·77
25–34					
Using straight line	1955	1·6	1·4	1·6	1·4
	1965	0·8	0·5	0·8	0·6
	1975	−0·1	−0·4	—	−0·3
Using exponential curve	1955	2·2	2·1	2·2	2·1
	1965	1·8	1·7	1·8	1·7
	1975	1·5	1·4	1·5	1·4
45–54					
Using straight line	1955	7·4	7·0	7·5	7·3
	1965	5·7	5·1	5·9	5·6
	1975	4·0	3·3	4·3	3·9
Using exponential curve	1955	8·3	8·1	8·4	8·3
	1965	7·2	7·0	7·4	7·3
	1975	6·3	6·1	6·5	6·4
65–74					
Using straight line	1955	49·5	48·8	49·9	49·5
	1965	46·3	45·4	47·0	46·5
	1975	43·1	41·9	44·1	43·5
Using exponential curve	1955	49·8	49·5	50·3	49·7
	1965	47·1	46·8	47·7	47·1
	1975	44·6	44·2	45·4	44·6

In the case of the straight line the divergencies shown in Table 4 are somewhat greater. Where this type of trend curve was to be used it appeared best to choose the mode of application which was least likely to lead to negative rates of mortality in the not distant future. Hence the life table factors based on the experience of quinquennial groups of calendar years were employed.

12. On these bases trend curves for England and Wales were constructed. The results for the exponential curve are shown in Chart I which, being drawn on a logarithmic scale, represents the exponential curve as a straight line.

It is apparent that on the whole the trend lines do adhere satisfactorily to the course of the crude rates over the period 1901–45. In the case of several age-groups they might also have been produced backwards into the later nineteenth century without serious discrepancies arising. Generally also there is no significant change of direction in the crude rates in the latter part of the period. There does, however, seem to have been some slowing down in the progress of the rate for middle-aged men (ages 45–64)—a feature less noticeable in the female experience—while on the other hand the mortality of older children (10–19) may have declined rather more quickly between the wars than the trend line shows.

Adaptation of the trend curves for the purposes of population projection

13. Adjustment in the level of each trend line was necessary for two reasons. In the first place, the figures upon which they were based related to England and Wales, whereas the projection is to relate to Great Britain as a whole. Although, as demonstrated in paragraph 4, the trends in the two countries are parallel, the effect of including Scotland is to produce mortality rates rather higher than those for England and Wales.

Secondly, it has been proposed that one basis for mortality should be that experienced in the years 1942–44 according to the life table which has been prepared for that period. The trend lines which were fitted to the data for 1901–45 as a whole do not, however, necessarily give values for 1942–44 which, when adjusted to allow for the higher mortality of Britain, coincide exactly with the rates actually experienced in that country in those particular years.

It seemed desirable that this apparent inconsistency should be eliminated for the purpose of choosing suitable assumptions for population projection. Accordingly the projected mortality rates for all future years according to the fitted curves were multiplied by the ratio of the death rate according to the British life table for 1942–44 to that according to the trend curve in 1943. The function tabulated $(1-{}_np_x)$ is the probability that a life now aged x will not survive for n years.

The results for the year 1978 are shown in Table 5.

TABLE 5

Projected mortality functions, Great Britain, 1978

Values of 1000 $(1-{}_np_x)$

Age-group x to x +n−1	Males: Projected rate for 1978 using: Exponential curve	Males: Projected rate for 1978 using: Straight line	Males: Corresponding value for 1942–44	Females: Projected rate for 1978 using: Exponential curve	Females: Projected rate for 1978 using: Straight line	Females: Corresponding value for 1942–44
0	28·9	—	56·5	22·6	—	44·4
1– 4	2·5	—	13·5	2·0	—	11·8
5– 9	3·5	—	7·5	2·3	—	5·8
10–14	3·0	1 4	5·4	2·1	—	4·5
15–19	6·6	5·3	9 4	5·5	3·9	8·2
20–24	9·1	6·7	13·0	8·1	6·7	11·2
25–34	14·3	—	27·6	13·4	2·7	23·8
35–44	21·5	—	41·5	15·4	—	31·6
45–54	59·1	38·0	92·7	34 0	8·7	61·5
55–64	154·7	137·8	205·5	82 0	51·6	131·5
65–74	356·8	351·1	415·7	235 0	215·6	313·6
75–84	717·2	717·1	740·1	573·8	574·1	641·1

Note: — represents negative values.

The level of mortality in the year 1978 according to the trend curves

14. The immediately obvious feature of Table 5 is the extent to which the use of straight lines as measures of the course of mortality gives rise to impossible results within thirty years. This renders valueless the employment of linear functions for any except the more advanced stages of life. Further, it implies that the absolute rate of fall in the death rates over the last forty years at ages under 50 cannot in general continue for as long in the future.

To use the exponential curve to express the trend of the mortality rate implies that the percentage decline in the rate during each decade is constant. On this basis the 1978 values of $1-{}_np_x$ do not on the whole appear unreasonable in the wide sense that there is no particular reason for supposing that a higher or lower figure would be more appropriate.

As between the age-groups there are, however quite wide variations in the rates of diminution. At ages 75–84, for instance, there is in the male section of the table a decline of only 3 per cent. between 1942–44 and 1978, whereas at ages 1–4 the corresponding figure is no less than 81 per cent. Moreover, the progression is somewhat irregular and does not pass smoothly from one age-group to another. Consequently a certain amount of change in the shape of the curve of deaths is implied, especially in childhood. Again, the ratios of female to male mortality are appreciably lower in 1978 on this basis than at present.

These changes may be regarded as no more than a continuation of past trends. It seems desirable, however, in order to get a perspective, to reconsider from a somewhat different aspect the extent to which it can be expected that the current trend of mortality in each age-group may continue unchanged.

One way in which this can be done—very broadly—is to make suitable comparisons with the data from the most progressive countries overseas. Table 6 gives values of $1{,}000\,(1-{}_np_x)$ corresponding to (*a*) the life table mortality rates for Britain in 1978 as obtained by the use of the exponential curve and (*b*) the lowest rates recorded up to 1944 in each age-group in any country. It will be seen that on the whole the projected figures represent an improvement upon the best current experience, except for men at the older ages. This improvement is on the whole moderate except at ages 1–4, where it is very striking. For most adult ages it is more marked in the case of women than men. Except perhaps at ages 1–4 there is nothing obviously improbable about the projected rates on this admittedly rough test.

TABLE 6

Projected mortality functions, Great Britain, 1978 compared with lowest values recorded up to 1944 in any country

Values of $1000\,(1-{}_np_x)$

Age-group x to x + n − 1	Males		Females	
	Projected rate based on exponential curve	Lowest recorded value up to 1944	Projected rate based on exponential curve	Lowest recorded value up to 1944
0	28·9	33 5	22·6	25·4
1–4	2·5	10 5	2·0	8·5
5–9	3·5	4·5	2·3	3·5
10–14	3·0	4·0	2 1	3 0
15–19	6·6	6 5	5·5	4·5
20–24	9·1	8·5	8·1	7·0
25–34	14·3	18·9	13·4	20 3
35–44	21·5	32·9	15·4	30·6
45–54	59·1	71·0	34·0	59·2
55–64	154·7	151·7	82 0	118·6
65–74	356·8	329·6	235·0	286·8

TABLE 7

Numbers of deaths and death rates per thousand from the main groups of causes in certain age-groups in selected years
England and Wales: males

Age-group	Year	Number of deaths in year from:— (death rates in brackets)								
		Infectious and parasitic diseases	Diseases of the nervous system and sense organs	Diseases of the circulatory system	Diseases of the respiratory system	Diseases of the digestive system	Non-venereal diseases of the genito-urinary system	Violence	Other causes	Total
1–4	1921	4,871 (–)*	1,012 (–)*	68 (–)*	4,716 (–)*	1,721 (–)*	99 (–)*	772 (–)*	654 (–)*	13,913 (–)*
	1927	5,045 (–)*	667 (–)*	51 (–)*	4,937 (–)*	839 (–)*	86 (–)*	787 (–)*	578 (–)*	12,990 (–)*
	1933	3,240(2·71)	416(0·35)	25(0·02)	2,590(2·16)	720(0·60)	67(0·06)	662(0·55)	516(0·43)	8,236(6·88)
	1939	1,468(1·27)	292(0·25)	30(0·03)	1,084(0·94)	424(0·37)	48(0·04)	593(0·51)	360(0·31)	4,299(3·72)
	1945	1,122(0·88)	224(0·18)	17(0·01)	696(0·55)	304(0·24)	38(0·03)	705(0·56)	425(0·33)	3,531(2·78)
10–14	1921	1,122(0·61)	322(0·17)	290(0·16)	270(0·15)	344(0·19)	74(0·04)	415(0·22)	397(0·22)	3,234(1·76)
	1927	814(0·48)	263(0·16)	188(0·11)	246(0·15)	277(0·16)	81(0·05)	394(0·23)	386(0·23)	2,649(1·57)
	1933	744(0·43)	231(0·13)	220(0·13)	231(0·13)	240(0·14)	75(0·04)	443(0·25)	427(0·24)	2,611(1·49)
	1939	405(0·27)	132(0·09)	145(0·09)	105(0·07)	155(0·10)	44(0·03)	369(0·24)	294(0·19)	1,649(1·08)
	1945	312(0·22)	98(0·07)	82(0·06)	83(0·06)	101(0·07)	33(0·02)	510(0·36)	234(0·17)	1,453(1·03)
25–34†	1921	4,659(1·78)	713(0·27)	1,290(0·49)	1,407(0·54)	563(0·22)	376(0·14)	1,156(0·44)	860(0·33)	11,024(4·21)
	1927	4,470(1·60)	656(0·24)	768(0·28)	1,147(0·41)	705(0·25)	344(0·12)	1,577(0·57)	801(0·29)	10,468(3·76)
	1933	4,749(1·46)	583(0·18)	853(0·26)	1,078(0·33)	743(0·23)	359(0·11)	2,013(0·62)	967(0·30)	11,345(3·49)
	1939	3,154(0·95)	487(0·15)	811(0·24)	612(0·19)	598(0·18)	373(0·11)	2,040(0·61)	1,040(0·31)	9,115(2·74)
45–54	1921	4,875(2·28)	2,416(1·13)	3,624(1·70)	3,746(1·76)	1,608(0·75)	1,392(0·65)	1,886(0·88)	4,808(2·25)	24,355(11·4)
	1927	6,021(2·64)	2,380(1·05)	4,376(1·92)	4,023(1·77)	2,014(0·88)	1,359(0·60)	2,164(0·95)	4,763(2·09)	27,100(11·9)
	1933	5,968(2·60)	1,775(0·77)	5,144(2·24)	3,659(1·59)	1,997(0·87)	1,261(0·55)	2,127(0·93)	4,943(2·15)	26,874(11·7)
	1939	3,987(1·68)	1,725(0·72)	6,085(2·56)	2,710(1·14)	1,846(0·78)	1,085(0·45)	2,109(0·89)	4,938(2·08)	24,485(10·3)
	1945	3,405(1·40)	1,643(0·68)	4,616(1·90)	3,140(1·29)	1,510(0·62)	930(0·38)	1,648(0·68)	5,241(2·15)	22,133(9·10)

* Not available.

† 1945 omitted because of the effects of the war.

15. An alternative approach may be provided by analysis according to medically certified cause of death; for if from present data some sign of an ultimate irreducible level of mortality can be seen, then the rates for 1978 shown in Table 5 may perhaps be modified in the light of this information.

One argument for assuming an " ultimate " level in mortality projection is that the position more than (say) thirty years ahead is so speculative that to continue any trend curve beyond that time except in the form of an unvarying death rate appears to be academic. Again, the aim of choosing alternative mortality bases for population projection is not to forecast the future course of the death rates for its own sake but to measure the possible extent of the influence of changes in experience upon population size and structure. This can adequately be done by using rates appreciably lower than those in force at present, such as are provided for instance by Table 5, but there is no great need to continue the decline indefinitely.

Unfortunately it is not practicable to analyse the mortality figures in a way which would reveal the effects of such general factors as developments in sanitation, advances in medical knowledge and skill and changes in standards of nutrition. It is, however, possible to study the relative importance of the various diseases causing death, by means of the large amount of data published by the Registrars General on this subject. Even in this field there are potential statistical difficulties arising from the developments in methods of diagnosis and changes in nomenclature and classification. These difficulties are, however, reduced if analysis is restricted to a few broad groups.

An idea of the extent to which the numbers of deaths and death rates from different groups of medical "causes" have been changing in recent years is given by Table 7. It relates to males in age-groups representing childhood, early maturity and middle age and gives the figures for every sixth year since the first world war. It will be seen from Chart I that, so far as the age-groups covered by Table 7 are concerned, the mortality rates for these years form a series not unrepresentative of the general trend.

The numbers of deaths are, of course, affected by the size of the population at risk. During the period 1921–45 there was an increase of around 20 per cent. in the numbers of men aged 25–34 and 45–54 but there was a corresponding decrease in the group 10–14. Moreover, even with a stationary population exposed to risk, some fluctuation from year to year in the numbers of deaths attributed to a particular group of diseases would be expected. There is, however, a general similarity between the movements of the numbers of deaths and the death rates.

16. To comment on Table 7 in detail:

Ages 1–4 *and* 10–14: The only cause from which there was not a sharp fall in mortality was violence, which accounted in 1945 for some 20 per cent of deaths at ages 1–4 and 35 per cent. at ages 10–14.

Ages 25–34: Here the experience of 1945 must be omitted because of abnormalities due to the war. It is clear that there was a diminution in the effects of the first four groups of causes shown; others, accounting for rather less than half the deaths in 1939, were stationary or even increasing.

Ages 45–54: Mortality from infectious and parasitic, nervous, respiratory and genito-urinary diseases fell, but stationary or increasing death rates were experienced in respect of circulatory and digestive diseases, violent deaths and other causes (including cancer), which together accounted in 1945 for a little over half the total mortality.

The results for the child age-groups are not particularly favourable to the idea of an ultimate level in mortality, nor do they afford much guidance as to what that level might be, unless it be held that accidental deaths will form an irreducible minimum. This analysis does not, therefore, assist greatly in

determining whether the shape of the curve of deaths in 1978 dependent upon the rates shown in Table 5 is reasonable or not.

In early and middle adult life not only violent deaths but also the mortalities from certain diseases are at present not declining. In these circumstances the rates for 1978 projected on the exponential curve appear sufficiently low in relation to mortality in 1942–44.

At the still older ages there has been relatively small progress in reducing mortality, and the question of an ultimate level hardly arises in connection with projections by means of trend curves.

Mortality in childhood

17. The prospective reduction in mortality at ages 1–4 on the exponential trend curve, which brings the rate for those ages to a point well below that for 5–9, instead of far above it as at present, and also leads to mortality rates only one-quarter as large as the best recorded in any country so far, appears to be excessive. It may therefore be deemed desirable to adjust the results of Table 5 by amending the mortality rates at ages 1–4 to (say) 4·0 for males and 3·0 for females. This would make the projected rates seem less abnormal but would have very little effect on the size of the projected populations.

Relationship between male and female death rates

18. Table 8 shows the relative mortalities of the sexes in certain age-groups at various periods during the last hundred years, together with the corresponding figures for 1978 derived from Table 5. It will be observed that in general the prospective situation thirty years hence is not necessarily inconsistent with developments in the past. A continuous change in the ratio of male to female mortality is, of course, implicit in the use of exponential curves for the secular trend if different rates of improvement are assumed for each sex. As will be seen from columns (1) and (2) of Table 8, the mortality rates for men have in the past fallen rather more slowly than the women's rates, with the result that the ratio in column (4) forms an increasing progression.

TABLE 8

The relationship between male and female mortality rates in selected age-groups over the last hundred years, England and Wales

Age-group	Years	Crude group death rates per 1,000			
		Male (1)	Female (2)	Differences Male−Female ((1)−(2)) (3)	Ratio Male/Female ((1)÷(2)) (4)
5–9	1841–45	8·82	8·56	·26	1·03
	1881–85	5·85	5·68	·17	1·03
	1921–25	2·55	2·41	·14	1·06
	1978	·70	·46	·24	1·52
20–24	1841–45	8·99	8·64	·35	1·04
	1881–85	6·00	5·93	·07	1·01
	1921–25	3·53	3·11	·42	1·14
	1978	1·82	1 62	·20	1·12
35–44	1841–45	12·2	12 1	·1	1·01
	1881–85	12·8	10·9	1·9	1·17
	1921–25	6·51	5·03	1·48	1·29
	1978	2·17	1·55	·62	1·40
65–74	1841–45	65·5	59·1	6·4	1·11
	1881–85	68·8	59·1	9·7	1·16
	1921–25	58·2	45·5	12·7	1·28
	1978	42·7	26·2	16·5	1·63

19. A summary of the matters discussed in the foregoing paragraphs is given at the end of this memorandum, and life tables based upon Table 5 appear in an Appendix. A description follows of some investigations that were made into the alternative general approach to the question of mortality projection which, as indicated in paragraph 2, was suggested by the Committee.

The " generation " approach to mortality

20. The idea underlying this approach is that each generation may possess a certain quality which is reflected in the mortality which members of the generation experience as they pass through life. This idea can readily be appreciated by dividing, age-group by age-group, the mortality rates experienced by persons born in one period by the rates experienced by persons born in another period. On a rigid interpretation of the generation hypothesis, viz., that mortality depends on year of birth alone and not on factors which change in the course of a lifetime, the resulting ratio should be the same for every age-group. There is, however, no reason to expect that the ratio obtained by comparing two generations in this way would bear any particular relation to the ratio obtained by comparing two other generations.

Alternatively, the rates of mortality experienced in a particular age-group by members of successive generations can be plotted against the year of birth. If the plotting is done on logarithmic paper, the curves for different age-groups should on the rigid theory be parallel.

21. In the present investigation the ratio method has been employed; subsequently curves were drawn to show the result of using the ratios for projection purposes. Table 9 gives the ratios, calculated as described above, obtained from the group death-rates for males in England and Wales in the " historical " table published in Part I of the Registrar General's Annual Review.

TABLE 9

Ratio, for each group of ages attained, of the mortality rate experienced by males born in quinquennium N to that experienced by males born in quinquennium N–1

England and Wales

Quinquennium of birth	N	Attained age								
		85 & over	75–84	65–74	55–64	45–54	35–44	25–34	15–24 (approx.)	5–14 (approx.)
1836 to 1840...	1	1·09	1·00	·99	·95	1·00	·94	1·04	·96	—
1841 to 1845 ..	2	·94	·97	1·00	·95	1·00	·96	·99	·98	·94
1846 to 1850. .	3	1·03	1·00	·98	·96	·94	·94	·87	·97	·98
1851 to 1855...	4	·79	1·00	·92	·97	·92	·98	·94	·92	·95
1856 to 1860...	5		1·03	1·00	·92	·91	·93	·91	·88	·90
1861 to 1865...	6		·87	·97	·89	·96	·88	·96	·90	·89
1866 to 1870 ..	7			1·00	·98	·94	·88	·92	·93	·90
1871 to 1875...	8			·91	·97	·83	·95	·91	·94	·89
1876 to 1880...	9				1·06	1 00	—*	·89	·92	·90
1881 to 1885. .	10				·92	·97	—*	·98	·90	·92
1886 to 1890...	11					·98	95	—*	·93	·91
1891 to 1895...	12					·90	·87	—*	—*	·94
1896 to 1900 ..	13						·92	·91	—*	1·04
1901 to 1905. .	14						—*	·90	—*	1·00
1906 to 1910...	15							·93	—*	·86

Looking along the rows in Table 9, it will be observed that the ratio is not absolutely constant for any one of the generations. On the graphic method, these irregularities appear as departures from parallelism and could no doubt be "ironed out" to a considerable extent by drawing smooth curves which would still adhere fairly closely to the plotted data. On the other hand, it has to be remembered that a good deal of "smoothing" has already been applied to the data by the use of ten-year age-groups for the mortality rates and five-year calendar periods to define the "generations". On the whole, however, Table 9 may be said to provide a working hypothesis for evaluating an alternative set of mortality rates for the purposes of population projection, provided that the results obtained are sufficiently distinct from those derived in earlier paragraphs to give rise to appreciable differences in the projected populations and thus to illustrate the effects of certain mortality variations.

22. The problem of projecting mortality, as seen from Table 9, is to determine the values of the ratios to be filled in the blank spaces of the Table in the light of the available data, having regard to the trend of the figures both horizontally and vertically. This is evidently a process which is applicable more to the older ages than the younger in so far as horizontal trends are concerned.

Assuming the generation influence to be paramount, the values in the blank spaces in any row could be determined from the average of the actual ratios on the right hand side of the table. The results of some illustrative calculations of this kind are set out in Table 10, after adjustment to a Great Britain basis in the same manner as was described in paragraph 13. Chart II (pp. 85-6) shows the crude age-group death rates in England and Wales for quinquennial groups of calendar years (omitting war years at the military ages) arranged on a generation plan and projected in a manner similar to that mentioned immediately above. Clearly the fall in mortality obtained in this way is substantially greater than that shown by the continuation of the exponential trend curves. In particular, there is an unprecedented diminution in the mortality at the older ages, which would appear to presuppose startling achievements in arresting the rate of organic decline and in lengthening the span of human life.

TABLE 10

Projected mortality functions for Great Britain in 1978, obtained by the rigid generation approach, compared with values by the exponential curve from Table 5

Values of 1000 $(1 - {}_np_x)$

Age-group x to x+n−1	Males		Females	
	By generation method	By exponential curve	By generation method	By exponential curve
	(1)	(2)	(3)	(4)
35–44	17·8	21·5	10·3	15·4
45–54	45 2	59·1	26·5	34·0
55–64	123·0	154·7	69·3	82·0
65–74	291·9	356·8	195·8	235·0
75–84	554·7	717·2	419·8	573·8

Modifications of the rigid generation approach

23. Upon close examination of the data in Table 9 there may seem to be some suggestion of a positive correlation between the ratio and the age attained; the ratios in any line of the table, which measure the improvement in mortality compared with that of the previous generation, tend to increase

with advancing age. Were such a divergence to be fully established it might be ascribed perhaps to a " wearing off " of the generation effect with advancing age, secular factors having more influence upon the mortality of the stock as the period lengthens during which individuals have been exposed to them.

There is a simple and effective way of allowing for the " slope " in the ratios in completing Table 9. From the available figures in a row the extent of the departure of any value from the average of those to its right is first measured. Thus in the third row (the generation born during 1846–50) the value of 0·98 at ages 65–74 is 0·04 higher than the average of the values for younger ages, viz., 0·96, 0·94, and so on. Such disparities are averaged for each age-group over all the rows for which there are data, and the result gives a measure of the upward tendency to the left. This may be used in turn to fill in the blank spaces in the Table. Supposing for instance that the ratios at ages 65–74 are found from the data to be, on average, 0·02 greater than the average of those to their right, the missing values in rows 9 and 10 can be calculated from the data to their right by using the same difference. These values can be used in turn to assist in determining the ratios at ages 75 and over in those rows.

24. The process which has just been described can be varied. Instead of measuring the disparities in any age-group from the averages of all the values to the right, a limited number of values to the immediate right may be used provided that the method is applied consistently. Experiments were made in order to find out whether the projected mortality functions would be much affected by such a change of process.

Table 11 shows the results obtained from the data set out in Table 9 and corresponding figures for the first five years of life, first on the unmodified generation approach, secondly on the process described in paragraph 23 and thirdly by the same method but using only the three ratios immediately to the right of any age-group in the analysis. For this purpose all the age-groups were decennial except at ages 0–4 and 85 and over. The corresponding figures for females are also given.

TABLE 11

Projected mortality functions for Great Britain in 1978, obtained by variants of the generation approach

Values of 1,000 $(1 - {}_np_x)$

(Based on total data for all generations born since 1836)

Age-group	Males			Females		
	By rigid generation approach (from Table 10) (1)	By adjusted generation approach (all ages) (2)	By adjusted generation approach (three age-groups) (3)	By rigid generation approach (from Table 10) (4)	By adjusted generation approach (all ages) (5)	By adjusted generation approach (three age-groups) (6)
35–44	17·8	13·0	16 0	10 3	8·0	10·0
45–54	45·2	39·0	48·0	26 5	24·0	27·0
55–64	123·0	129·0	127·0	69·3	65·0	63·0
65–74 . ..	291·9	338·0	384·0	195 8	212·0	219·0
75–84	554·7	625·0	676 0	419·8	462·0	472·0

Columns (5) and (6) are rather similar and it may be said that for females there is little to choose between the two methods. In the case of males, however, the results in column (3) at ages 65 and over considerably exceed those in column (2). These differences arise mainly from the high ratios at ages 45–65 in line 9 of Table 9, a feature not reflected in the female experience.

In general, the method used in obtaining columns (3) and (6) may be preferable to that of columns (2) and (5) in that it gives greater weight to current experience. For men, however, it may not be wholly appropriate that the recent slowing up in the decline of mortality in middle life should be assumed to spread to the older ages in future.

While the three-age-group method has been employed throughout in the tests which will subsequently be described in this memorandum, it is worth bearing in mind that different results for the older men would be obtained by using all ages.

Scope of the data to be used

25. The results obtained by the generation approach and its modifications may vary according to the extent of the past experience which is used as a basis for projections. The following possible changes from the data shown in Table 9 appeared to merit some investigation:—

(1) Exclusion of the age-group 0–4.
(2) Inclusion of generations born before 1836.
(3) Exclusion of the 1941–45 experience.

26. The first of these amendments may be thought desirable on the ground that mortality at ages under one year, which dominates the age-group, has been so subject to secular effects as to upset the generation approach. Against this may be set the undesirability of arbitrarily excluding any portion of the data and particularly that period of life where the generation effect might be expected to be strongest.

Table 12 shows the effect of omitting ages 0–4 from the calculations on which the results shown in columns (3) and (6) of Table 11 were based.

TABLE 12

Projected mortality functions for Great Britain in 1978 obtained by a variant of the generation approach

Values of 1,000 $(1 - {}_{n}p_{x})$

(Age-group 0–4 included or excluded, but otherwise the results are based on total data for all generations born since 1836)

Age-group	Males		Females	
	Table 11, Col. (3) (1)	The same if ages 0–4 excluded (2)	Table 11, Col. (6) (3)	The same if ages 0–4 excluded (4)
35–44	16	21	10	12
45–54	48	56	27	31
55–64	127	135	63	66
65–74	384	384	219	219
75–84	676	676	472	472

Some increase in the projected rates of mortality is caused at ages under 65 by the exclusion of ages 0–4 in the modified generation process.

27. The first generation for which recorded mortality experience throughout the whole of life is available is that born in 1836–40, which was accordingly shown in the top row in Table 9. The method described in paragraph 24

does not, however, preclude the use of data relating to earlier generations and it is important to see whether to do so would affect the results obtained in projection. Table 13 shows most of the additional information which is available in respect of males.

TABLE 13

Ratio, for each group of ages attained, of the mortality rate experienced by males born in quinquennium N to that experienced by males born in quinquennium N–1

Males, England and Wales

Quinquennium of birth	N	Attained age 85 & over	75–84	65–74	55–64	45–54	35–44	25–34
1786–1790 ...	−9	1·02	1 02	96	1 10	—	—	—
1791–1795 ...	−8	·90	1·01	1·03	·95	—	—	—
1796–1800 .	−7	1·05	1·02	1 02	96	1·12	—	—
1801–1805 ..	−6	·93	96	1 03	1·08	·97	—	—
1806–1810 ...	−5	·97	1 02	99	1·02	·94	1 12	—
1811–1815 ...	−4	·97	1 01	99	1·04	1·08	·95	—
1816–1820 ...	−3	1·03	·96	1 05	1·00	1 04	·95	1·12
1821–1825 ..	−2	1·00	·96	1 01	·98	1·04	1 08	95
1826–1830 ...	−1	·95	1·00	94	1 03	98	1·04	92
1831–1835 .	0	1·02	1·01	·96	1 02	98	1 04	1·06
1836–1840 ...	1	1·09	1 00	·99	95	1·00	·94	1·04

28. These data follow a different pattern from those in Table 9. Successive generations do not show an ever-improving mortality and no definite trend is apparent within the rows. Thus to include the earlier generations has the effect of watering down the " sloping " features of Table 9.

It may be argued that the older experience is irrelevant to the more modern developments. At the same time it can hardly be completely ignored. Consequently Table 14 has been prepared to illustrate the influence upon the projected mortality functions of bringing the generations born during 1816–1835 into the computation of the corrections for the rise in the ratios to the left of the table.

TABLE 14

Projected mortality functions for Great Britain in 1978 obtained by a variant of the generation approach

Values of 1,000 $(1-{}_{n}p_{x})$

(Generations born 1816–1835 included or excluded; but otherwise the results are based on total data for all generations born since 1836)

Age-group	Males: Table 11, Col (3) (1)	Males: The same if generations born 1816–35 are included (2)	Males: By rigid generation approach (3)	Females: Table 11, Col (6) (4)	Females: The same if generations born 1816–35 are included (5)	Females: By rigid generation approach (6)
35–44	16	17	17 8	10	10	10·3
45–54	48	46	45 2	27	27	26·5
55–64 . ..	127	124	123·0	63	67	69·3
65–74	384	341	291 9	219	206	195·8
75–84	676	617	554·7	472	424	419·8

The effect in columns (2) and (5) at the older ages is to produce results akin to those by the unadjusted generation approach for women—and also in the case of men if the method in column (2) of Table 11 were employed instead of that in column (3) of Table 11.

29. Mortality at all ages over 55 was markedly lower in 1941–45 than in the preceding quinquennia. This sharp decrease appears to have been attributable at least in part to the coming into general use of the sulphonamides and penicillin. Such a development obviously upsets any generation approach to mortality projection; it may be that for this reason the experience of the period in question should be excluded from the calculations. Against this it may be argued that the arbitrary omission of any data is undesirable in a method which purports to be universal in scope. Further, it is not possible either to attribute recent developments with certainty to one cause or to be sure that similar changes, happening less rapidly but no less surely, are not included in the experience of other years.

Table 15 has been prepared in order to demonstrate the influence of the 1941–45 experience on the results obtained above.

The effect is to raise the projected rates at the older ages to a level higher than that on the exponential approach; in fact they are even above the present-day level.

30. The foregoing experimental calculations appear to demonstrate that the modified generation approach is a flexible tool requiring careful setting before use. Nevertheless, it is suggested that however the body of available data is trimmed the remainder is likely to retain certain peculiarities and that it is therefore more appropriate in an approach of this kind to use the data for all ages and all recent periods without arbitrary limitation.

TABLE 15

Projected mortality functions for Great Britain in 1978, obtained by the exponential curve and variants of the generation approaches

Values of 1,000 $(1 - {}_np_x)$

(Experience of 1941–45 included or excluded; but otherwise the results are based on total data for all generations born since 1836)

Age-group	Males				Females			
	By rigid generation approach (1)	Table 11, Col. (3) (2)	The same if 1941–45 excluded (3)	By exponential approach (4)	By rigid generation approach (5)	Table 11, Col. (6) (6)	The same if 1941–45 excluded (7)	By exponential approach (8)
35–44	17 8	16	16	21·5	10·3	10	10	15·4
45–54	45·2	48	48	59·1	26·5	27	30	34·0
55–64	123·0	127	144	154·7	69·3	63	79	82·0
65–74	291·9	384	425	356·8	195·8	219	272	235·0
75–84	554·7	676	797	717 2	419·8	472	625	573·8

Summary

31. (*a*) It is sufficient to measure the course of British mortality by means of the figures for England and Wales (paragraph 4) subject to subsequent adjustment in the manner described in paragraph 13.

(*b*) The investigation was concerned mainly with the period 1901–45 (paragraph 8).

(*c*) The exponential curve is advantageous as a simple and effective measure of the broad trend of the death rates. Other curves which were tested were considered, for various reasons, to be inferior for projection purposes (paragraphs 9 and 10).

(*d*) Exponential trend curves were fitted to the data for 1901–45 in what appeared to be the most appropriate manner (paragraph 11) and were produced as far as the year 1978 as a possible guide to the choice of an alternative mortality basis for population projection (paragraph 7).

(*e*) Certain minor modifications to the exponential trend curves for the ages of childhood seemed desirable (paragraph 17). The relationships between the projected male and female rates in the year 1978 did not appear on examination to be obviously unreasonable (paragraph 18).

(*f*) The evidence is insufficient for the determination of an ultimate level in mortality in the future; but continuation of the trend curves beyond (say) 1978 is not strictly necessary for the purpose of population projection (paragraphs 15 and 16).

(*g*) An arithmetical technique for the rigid "generation" approach to mortality was used and an illustrative set of death rates for the year 1978 was produced on this basis (paragraphs 21 and 22).

(*h*) There appeared to be some evidence of a progressive weakening in the generation effect with advancing age, and several experiments were made in modifying the rather extreme results of the strict generation approach at the older ages (paragraphs 23–29). Tests showed that the results obtained depended in considerable degree upon the extent of the data used, in particular according to whether ages 0–4, generations born before 1836 and the experience of the calendar years 1941–45 were included or excluded.

APPENDIX

SKELETON LIFE TABLES ILLUSTRATING POSSIBLE BASES FOR MORTALITY PROJECTION

GREAT BRITAIN

Age x	Numbers living at age x					
	Males			Females		
	Mortality of 1942–44	Mortality of 1978		Mortality of 1942–44	Mortality of 1978	
		On exponential curve*	On rigid generation method		On exponential curve*	On rigid generation method
0	10,000	10,000		10,000	10,000	
1	9,435	9,711		9,556	9,774	
5	9,307	9,672		9,443	9,745	
10	9,238	9,638		9,388	9,723	
15	9,187	9,609		9,345	9,703	
20	9,101	9,546		9,269	9,650	
25	8,983	9,459		9,165	9,572	
35	8,736	9,324	9,324 (say)	8,947	9,444	9,444 (say)
45	8,373	9,124	9,158	8,664	9,299	9,347
55	7,597	8,585	8,744	8,131	8,983	9,099
65	6,035	7,257	7,668	7,062	8,246	8,468
75	3,526	4,668	5,430	4,847	6,308	6,810
85	916	1,320	2,418	1,740	2,688	3,951
Approximate expectation of life at birth .	62·7	69·0	71·5	67·4	74·0	76·2

* Adjusted as suggested in paragraph 17 in respect of the age-group 1–4.

Note by the Statistics Committee

After considering the foregoing memorandum we decided not to use the "generation approach" as a basis for framing an assumption about the course of future mortality, but to adopt two alternative assumptions as follows:—

(1) that the Great Britain mortality rates of 1942–44 would continue without increase or decrease;

(2) that mortality rates would decline according to the exponential curves described in paragraphs 9–13 above, with a modification of the rates so projected for the age-group 1–4 as suggested in paragraph 17. The decline was assumed to cease in the quinquennium 1977–82, the rates thereafter remaining constant at the levels then reached. The death rates so projected were converted by a suitable approximate process into survival factors convenient for use in projecting the population (see the Report on Projections, Table IV).

In connexion with assumption (2), the Government Actuary's Department furnished us at our request with the following note.

Supplementary Note by the Government Actuary's Department

The assumption that rates of mortality after 1977–82 would remain at the level of that quinquennium is of course both arbitrary and unrealistic. It was adopted for convenience of computation for a series of estimates the purpose of which was mainly illustrative. To have allowed for mortality changes over a future span of a hundred years would have called for a highly speculative review of possible future trends and would have required an amount of additional work which the circumstances could not be held to justify.

In order, however, to indicate broadly the level of mortality which might be reached on this hypothesis in a hundred years, the exponential curves developed in " The Course of Mortality in Great Britain " have been carried forward to the year 2048. The results for males are given below for five-year age-groups, with the corresponding values (i) on the 1942–44 lifetable, and (ii) for the year 1978 as projected.

VALUES OF THE CENTRAL DEATH RATE PER THOUSAND FOR THE UNDERMENTIONED AGE-GROUPS

Males: Great Britain

Age-group	1942–44	1978	2048
0	56·5*	28·9*	10 8*
1–4	3·4	·6	·02
5–9	1·5	·7	2
10–14	1·1	·6	·2
15–19	1·9	1·3	·6
20–24	2·6	1·8	·9
25–34	2 8	1 4	·4
35–44	4·2	2·2	·6
45–54	9 7	6·1	2·4
55–64	23	17	9
65–74	52	43	29
75–84	123	116	105

* Number of deaths per thousand births.

It will be seen that the further projection on the exponential curve produces very light mortality rates under age 1 and for the young and middle ages, and it gives a further substantial improvement at the older ages. It does not appear, however, that over any wide span of ages the method has broken down by the year 2048 or results in values which can be said to be highly unlikely.

CHART I

Crude Age-group Death Rates—England and Wales

Part I—Males—Aged 25 and over

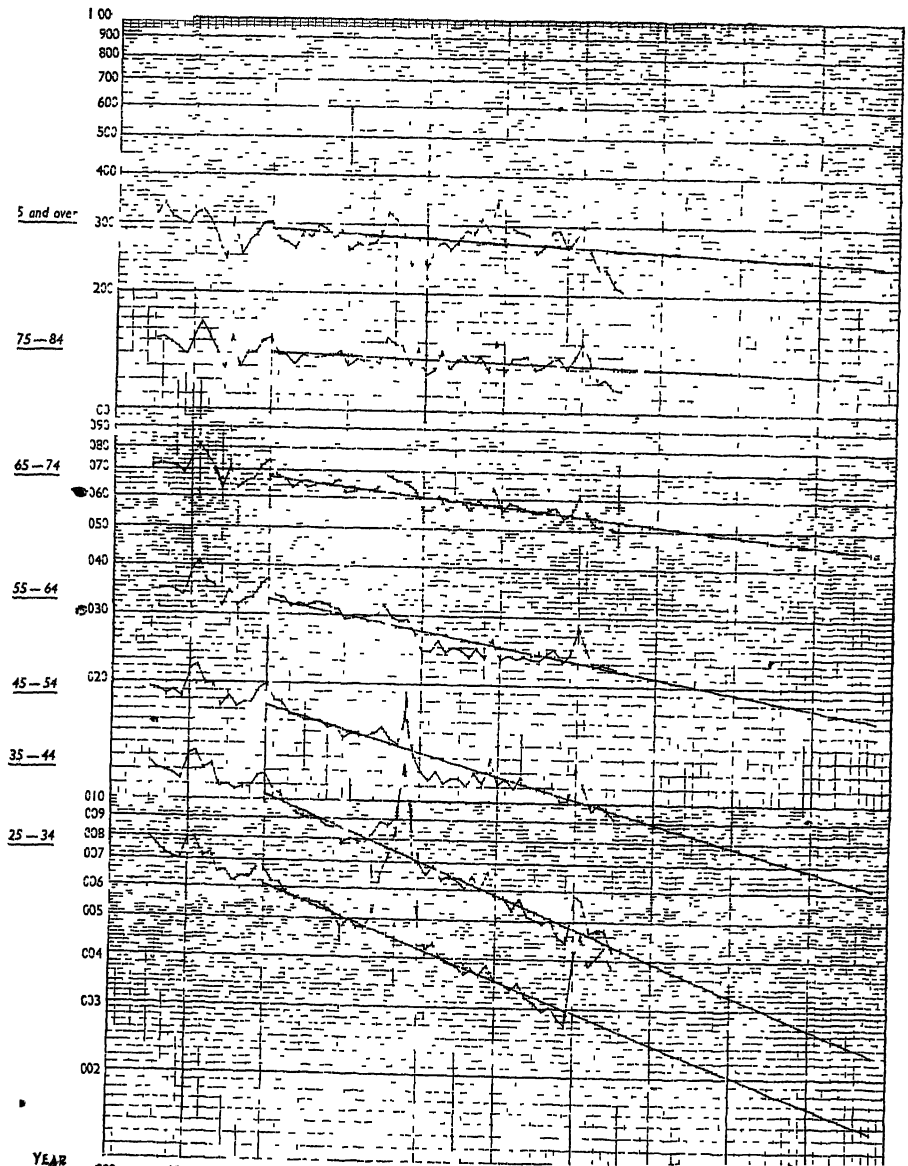


CHART I

Crude Age-group Death Rates—England and Wales

Part II—Females—Aged 25 and over

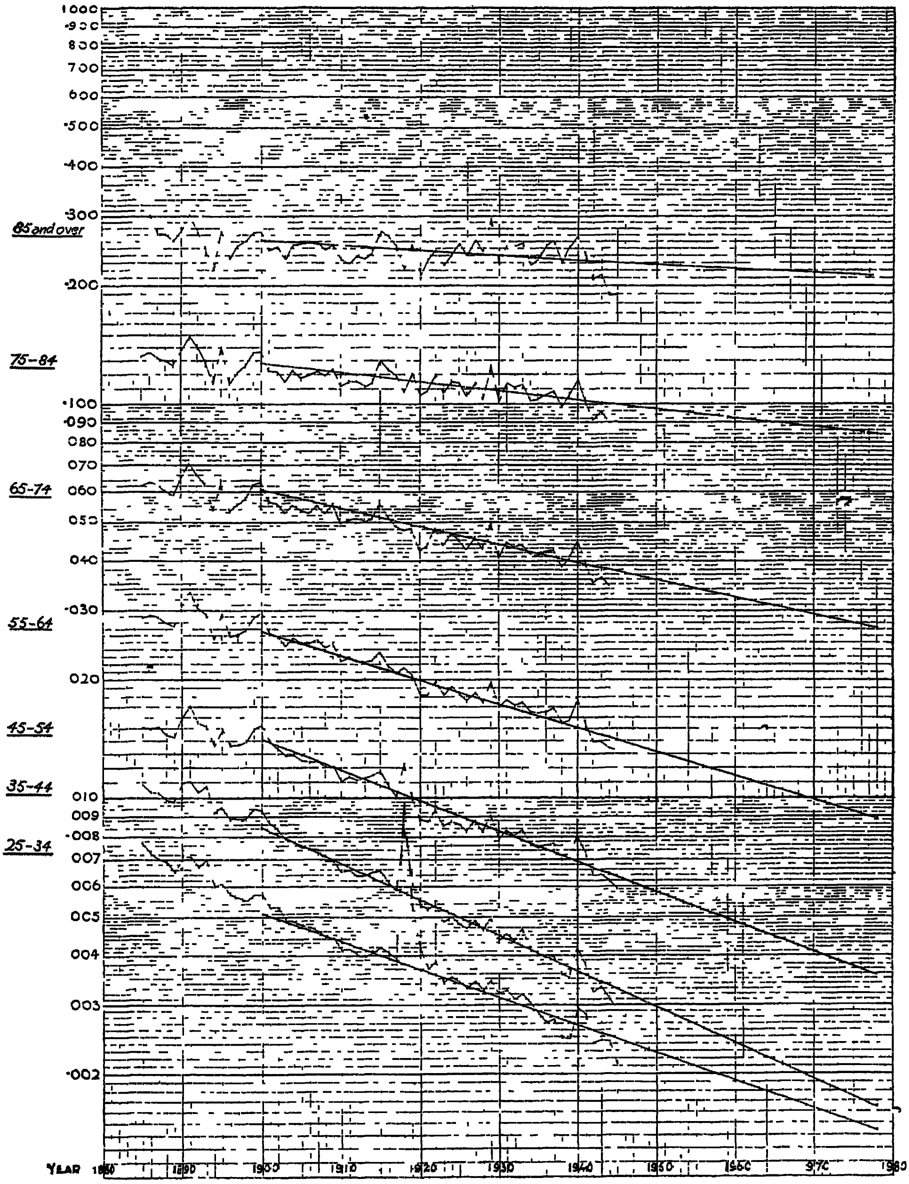


CHART I

Crude Age-group Death Rates—England and Wales

Part III—Ages 15–24

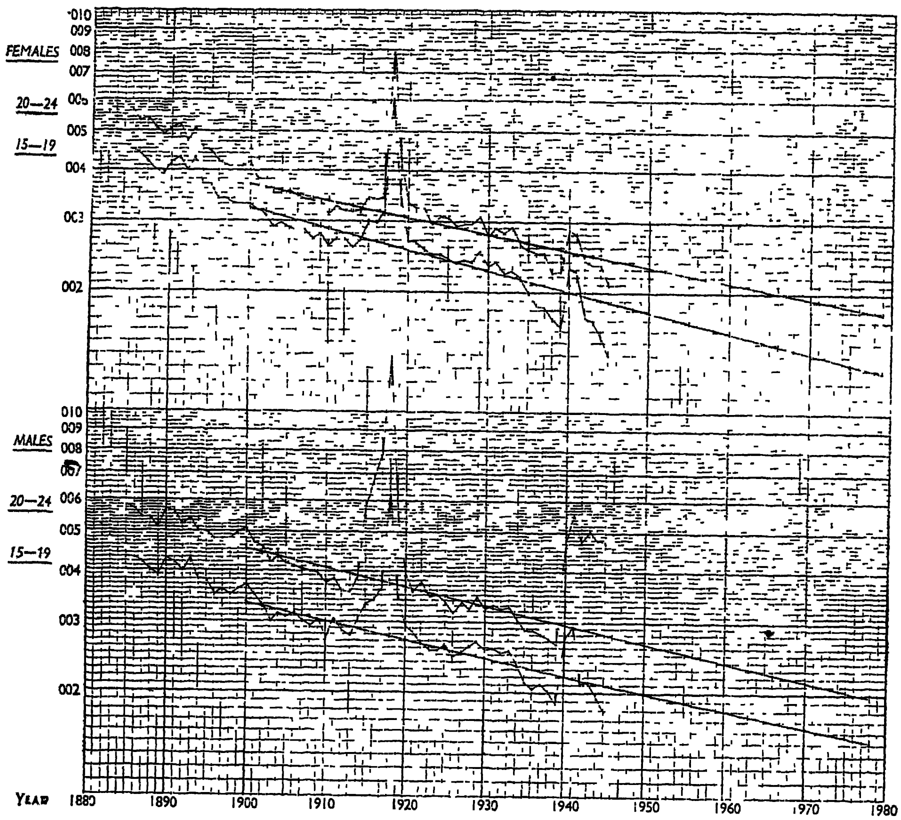


CHART I

Crude Age-group Death Rates—England and Wales

Part IV—Males—Aged 0–14

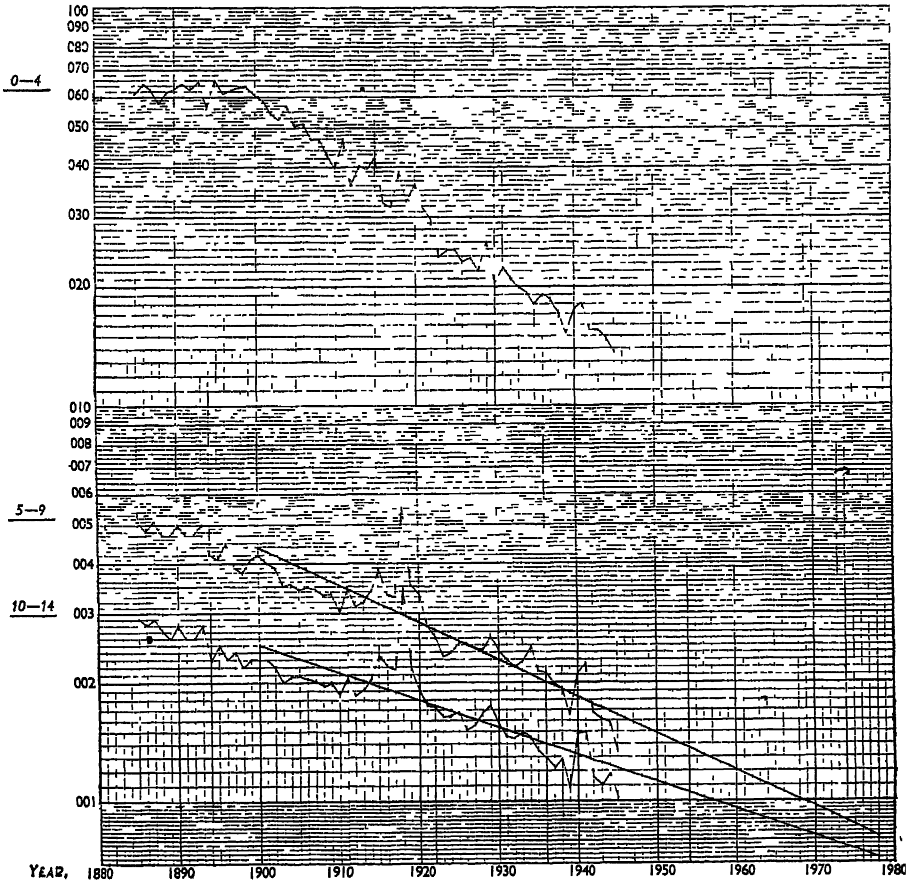


CHART I

Crude Age-group Death Rates—England and Wales

Part V—Females—Aged 0–14

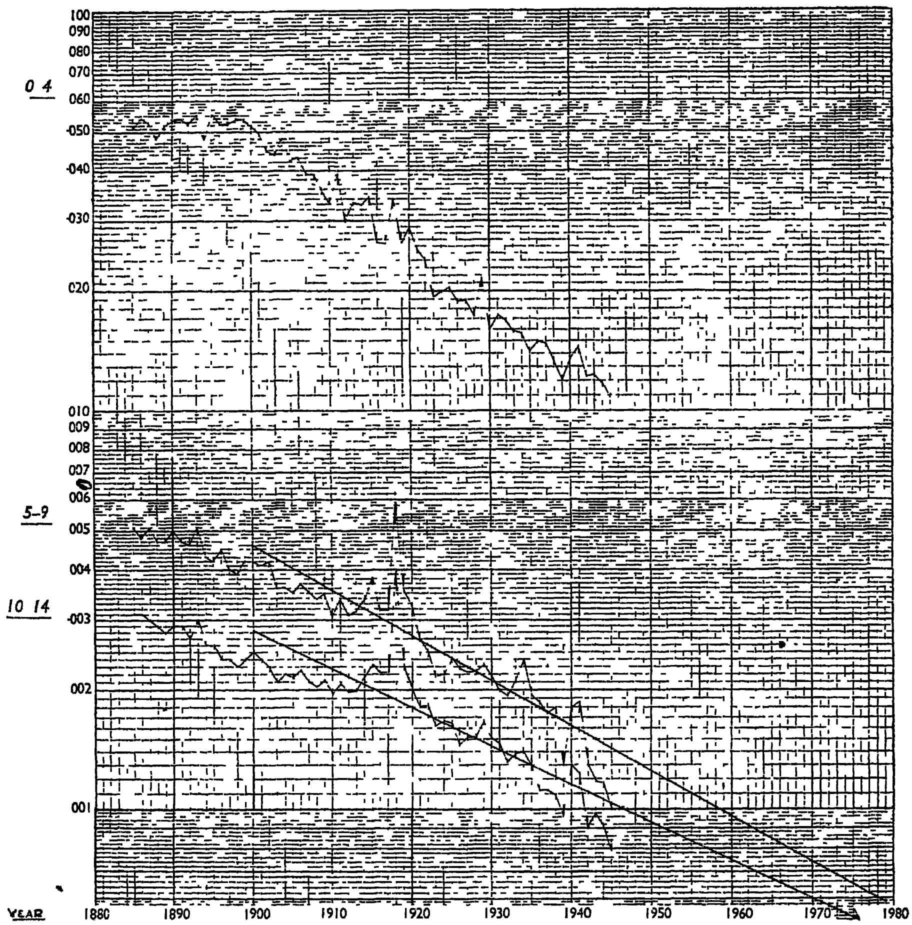


CHART II

Crude Age-group Mortality Rates—England and Wales

Arranged on a Generation Plan—Males

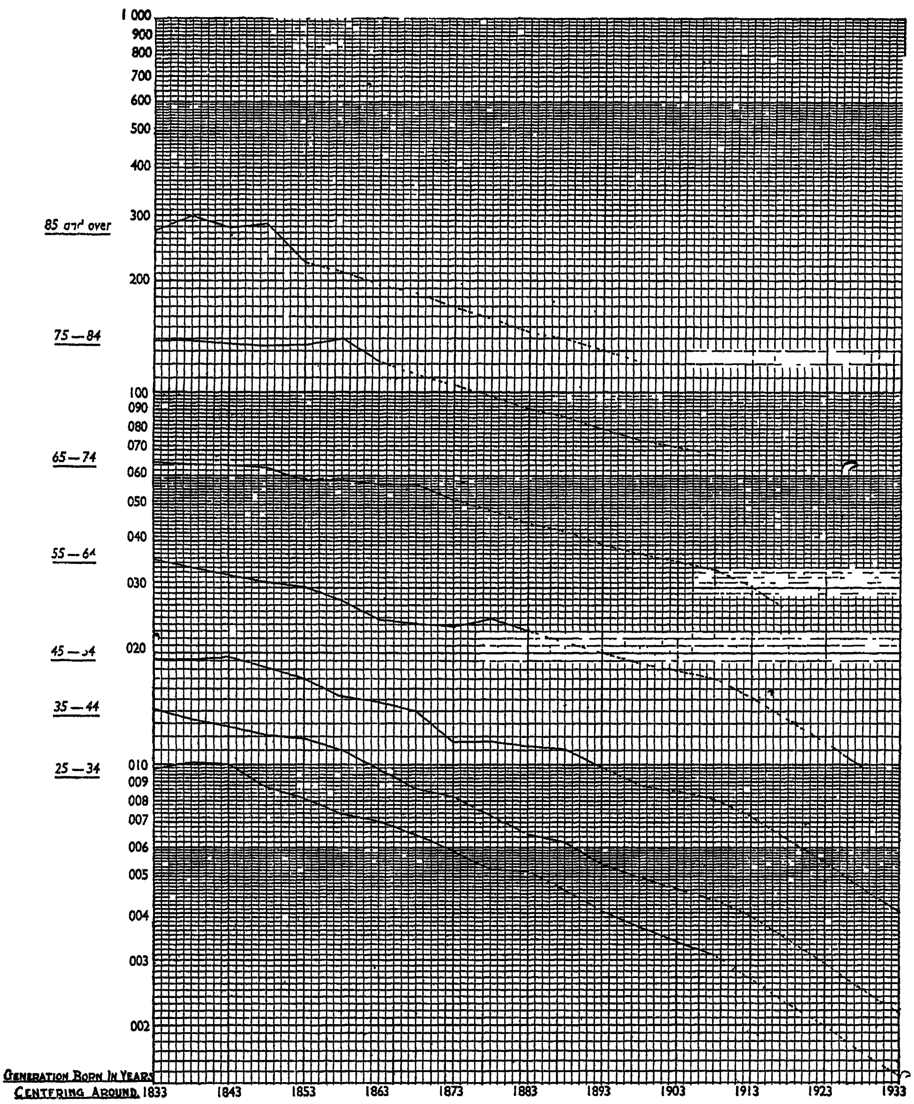
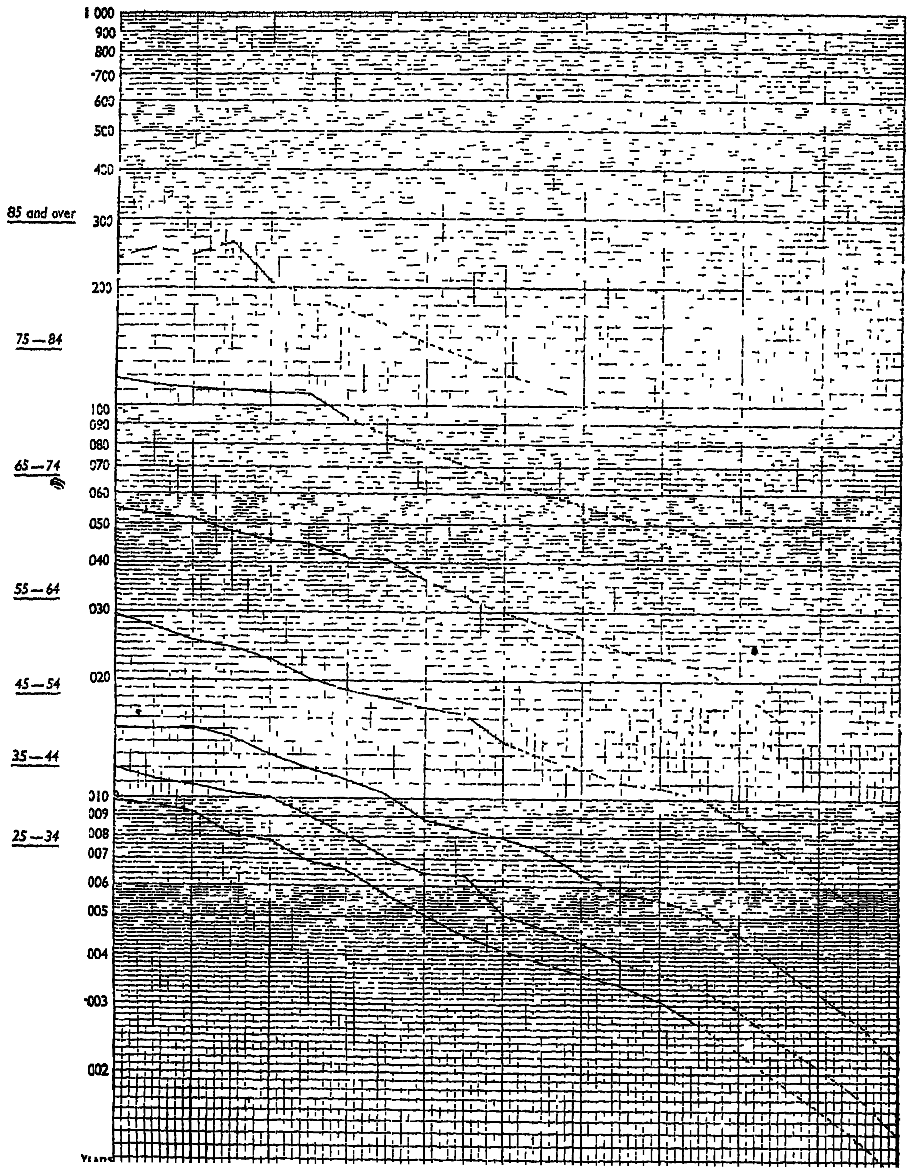


CHART II

Crude Age-group Mortality Rates—England and Wales

Arranged on a Generation Plan—Females



The Family Census: a Preliminary Report

BY D. V. GLASS AND E. GREBENIK

The introduction to the present collection of papers has already explained that the Family Census was taken to provide new data on fertility, data of a kind not obtainable in any other way. The full results of the Family Census will be published in separate reports. But since the provisional results have been used by the Royal Commission and are cited in their report, it is desirable that some preliminary account be given of the way in which the Census was taken and of the relevance of the results to the study of fertility patterns and trends in Great Britain. It is, therefore, the object of this paper to discuss, in somewhat general terms, the methods used in taking the Census and the problems involved in analysing the information collected, as well as to give, by way of example, a number of basic tables derived from the provisional results.

The purpose of the Census was to obtain information relating to the fertility of those women in Great Britain who, at the time of investigation, were or had been married. Originally it was hoped that the Census might be carried out by the Registrars General, using the customary Census machinery. But it soon became evident that, because of practical difficulties, the Registrars General would not be able to do this. Accordingly, it was decided to take the Census on a sample basis and with an *ad hoc* organisation. Because of the desire for detailed analysis of the results—by individual marriage cohorts, by age at marriage and by social class—a large number of cases were required and it was therefore decided that a 10 per cent. sample should be taken. At the same time, the use of a sample raised a number of problems: how should the sample be drawn; what kind of organisation should be recruited to carry out the inquiry; and since, by using a sample, the compulsory powers of the 1920 Census Act could not be invoked, what steps should be taken to minimise the possibility of refusal to co-operate on the part of women drawn in the sample?

The Sample

The problem of sampling was greatly simplified by the existence of the National Registration system, allocating a separate card to each person resident in Great Britain, and, linked to National Registration, of a food rationing system providing a ration book for each individual. Each Food Office has a file consisting of the reference leaves removed from the last ration book, when it was exchanged for a new one, the leaves bearing the names, addresses and National Registration numbers of the persons concerned. The leaves are arranged alphabetically by order of surname, and there is a separate file for persons aged 18 years and over. A difficulty arises in that in many Food Offices the file is not kept completely up-to-date. When a person moves into an area and takes his identity card and ration book to the local Food Office, a " dummy leaf " is inserted in the file, recording his name, new address, and registration number. But when a person dies or leaves an area, his reference leaf is often not removed from the file, which is thus inflated in relation to the actual population present in the area at a given time. Ration

books are exchanged each year and new files then set up. But internal migration is substantial and the further away from the actual date of the exchange of ration books, the more inflated the file will be, and the more likely it is that, in sampling, the name of a given person will be drawn in more than one area. It is, however, possible to overcome this difficulty by checking the sample against the maintenance file of the National Registration system, this being a " live " file kept up-to-date by adding cards for in-migrants, and by removing cards for out-migrants and for persons dying, information on out-migrants being supplied through the central office of the National Registration system.

The primary reason for using the ration book reference leaves, rather than the National Registration maintenance file, for drawing the sample was that, at the exchange of ration books in the summer of 1945, the Ministry of Food had helped to define more closely the universe of the inquiry by asking in respect of each woman for whom a ration book was exchanged, whether she was " Mrs." or " Miss." The universe would thus theoretically consist of all women describing themselves as " Mrs."—that is, all married, widowed and divorced women. In practice, however, it was not possible to confine the universe to those women. Two factors had to be taken into account. First, the exchange of ration books took place in the summer of 1945, while the sample was not drawn until January, 1946. During the interval a number of single women would have married and it was desirable that they should be taken into account. Secondly, and much more important, at the exchange of ration books it was not possible to ensure that every woman stated her marital condition. In many cases ration books were presented in bundles, and it would have been impossible, as well as unjustified, to withhold a new ration book from a woman who had forgotten or refused to give the information desired. A sample check, taken in a hundred areas on a specific day, showed that only 82 per cent. of the women had complied with the request. Nevertheless, the fact that the large majority of the women had done so, made the sampling problem considerably easier, in that only a proportion of the final sample consisted of women of unknown status.

In consultation with Dr. F. Yates, Director of Statistics of the Rothamsted Experimental Station, the following sampling procedure was devised:

(i) The sample was to be drawn separately in each of the Food Offices in Great Britain (1189 Food Offices), under the supervision of the local Food Executive Officer.

(ii) On a selected day every tenth reference leaf was to be withdrawn from the alphabetical file of ration book reference leaves relating to persons aged 18 and over. This would constitute the initial sample (1).

(iii) By reference to Christian names, the leaves for men would then be discarded.

(iv) The leaves for women who had described themselves as " Miss," and who had not changed their surnames since the last exchange of ration books, would also be discarded.

(v) The remaining reference leaves would thus cover women described as " Mrs.", women described as " Miss " but who had changed their surnames (this being regarded as an initial presumption of marriage),

(1) Married women under 18 years of age were thus excluded. But these would be very few, and would consist only of women marrying at age 16 in 1944 and ages 16 and 17 in 1945.

and women who had given no indication of their marital condition. These remaining leaves would thus constitute the provisional sample, and would include a proportion of single women to whom the Census schedule would not apply. But this was unavoidable if the ultimate sample was to be correct. During the enumeration, as the single women in the provisional sample were identified, the schedules relating to them would be rejected.

(vi) The provisional sample would then be checked against the National Registration maintenance file, addresses corrected where necessary, and the leaves for women who had died or moved out of the specific Food Office area eliminated. The remaining leaves would constitute the final working sample, and would be arranged in alphabetical order and numbered serially within each Food Office. These alphabetical leaves would then be used for addressing envelopes containing the Census schedules, and as the basis for preparing street lists for enumerators.

(vii) One further source of error still remained. Owing to the time lag in the receipt in the area of previous residence of the notification that a given woman had moved to another area, it was possible that the same person would be listed in the final working samples of two areas. It would therefore be necessary to scrutinise in each Food Office area the notifications of removal received during the period of the enumeration. If a woman had registered in a new area before the date on which the sample was drawn, her name would have to be checked against the sample in the area of previous residence, and if her name appeared on that sample it would have to be deleted. This instruction was included in the sampling procedure.

(viii) No substitutions would be allowed. Every effort would be made to locate the women drawn in the sample and to persuade these women to complete their schedules. But if they could not be found or would not respond, no alternative women were to be selected.(1)

The Organisation of the Census

In carrying out the actual investigation it was decided that the Census schedules, together with accompanying letters, should be posted to all the women drawn in the sample and that enumerators should then call on the women concerned and scrutinise and collect the completed schedules, helping the women, where necessary, with any difficulties or queries which might have arisen. Enumerators would, if necessary, call at least three times on any woman in an endeavour to locate her and collect her schedule. If the first visit was unsuccessful, a note would be left by the enumerator, informing the woman when he would next call. On the basis of two small pilot inquiries undertaken by the British Institute of Public Opinion, it was estimated that an allowance of about 30 minutes per completed schedule would have to be made, including in that allowance the time spent in travelling from one address to another and in recalls at the addresses of women who were not at home when the first call was made. It was also estimated, on the basis of official statistics, that the sample would consist of some 1·5 million women, including

(1) The presumption on which this rule is based is the following. Among the substitutes (if substitutes are used), the women who can be found and who will respond will not have the same characteristics as those who, in the original sample, could not be found or would not respond. This may not always be true. But unless it can be shown to be untrue for the particular inquiry, it is safer to avoid substitutes.

those of unknown marital status. In view of the man-power situation, only part-time interviewing could be envisaged, with not more than 15 hours per week on the average for each interviewer. If the Census were spread over a month, this would mean using some 13,000 interviewers. Supervisors would also be required and it was estimated that about 1,200 (both part-time and full-time) would be needed in England and Wales. Further, it was considered desirable, that in England and Wales some more centralised control of the local supervisors should be exercised. This was achieved by appointing 28 divisional supervisors—responsible and experienced administrators seconded for the duration of the Census by the Assistance Board. The enumerators and local supervisors were recruited with the help of announcements by the Ministry of Labour and by the B.B.C.

In Scotland the procedure was somewhat different. The Scottish Food Office areas (of which there were 57) were too large to be convenient administrative units. With the encouragement of the Registrar-General, the local registrars agreed to act as supervisors and to recruit enumerators. The enumeration procedure was altered accordingly. When the sample was drawn in each Food Office area, the names and addresses were sent to the General Registry Office, Edinburgh, where they were sorted into smaller groups corresponding to the area of each local registrar, and forwarded to the various local registrars concerned. Thus in Scotland the Family Census was in reality carried out by the officers who would be responsible for a normal census. Moreover, the Scottish General Registry Office agreed to make itself responsible for the whole of the administration of the Census in Scotland, including the answering of queries and the central scrutiny of completed schedules. The special difficulties of carrying out the inquiry in Scotland were such that, without this generous help, it is doubtful if the Census could have been taken there. As it was, the organisation worked extremely well and was, indeed, more effective than the *ad hoc* machinery set up in England and Wales.

Taking Great Britain in general, however, the Census organisation was reasonably effective, especially considering the fact that the vast majority of the enumerators and supervisors were untrained, with little comparable experience, and that the whole structure was created in less than two months. To fit in with the work-load of the Food Offices, it was agreed to carry out the inquiry in January, 1946, even though weather conditions and short days would thereby place an additional strain on enumerators. The drawing of the sample was begun on January 7th, and two weeks were allowed for compiling the resultant lists of names and addresses, allocating them to specific enumerators, and mailing the Census schedules and accompanying letters to the women drawn in the sample. In spite of various difficulties which arose, the enumeration got under way fairly smoothly and in most parts of the country enumerators began, as from January 21st, to call on the women drawn in the sample and to collect the completed schedules. In Scotland, because of the additional process involved, the enumeration began, as was planned, a little later. Similarly, in most parts of the country the enumeration was substantially completed by February 23rd.

Attention should be drawn to one further point. Provision was made for enumerators to call, if necessary, at least three times at any address in order to find women who were not in at the first call. Since payment to enumerators was on the basis of completed schedules, there would be an incentive to locate the women, even if supplementary visits were necessary. At the same time, in order to counter any desire to earn fees by inserting, for women who could not be located, fictitious information in the spare schedules

with which every enumerator would have to be provided, it was arranged that every spare schedule should have a hole punched in it. Any local supervisor noticing an excessive proportion of punched-hole schedules among the returns for an enumerator, would report this to a divisional supervisor, who would arrange for a check to be made. In practice a few cases of this kind did arise. But the vast majority of enumerators did their work honestly and with a sense of public service.

It has been noted that the man-power shortage conditioned the way in which the enumeration was organised. It also affected the plans for the analysis of the results. Because of the difficulty of obtaining full-time clerks, it was decided to reduce to a minimum the central scrutiny and coding of the completed schedules, and the Census schedule was thus designed to facilitate coding by the enumerators and scrutiny and checking by the local supervisors. This applied especially to the coding of husband's occupation(1). No detailed classification was possible. Instead, a relatively simple method was provided for grouping occupations into ten social classes, namely (1) professional; (2) employers of 10 or more persons (excluding professional persons); (3) workers on own account, or employing fewer than 10 persons; (4) salaried employees; (5) non-manual wage-earners; (6) manual wage-earners; (7) farmers and farm-managers; (8) farm and agricultural workers other than managers; (9) casual or unskilled labourers; and (10) persons temporarily in the Armed Forces and with no previous occupation. To facilitate the coding, the question on husband's occupation was framed rather more elaborately than is normal at a census. In addition to a detailed description of the employment and industry, each woman drawn in the sample was asked to state whether her husband was an employer of 10 or more people; or working for himself or employing fewer than 10 people; or, employed and earning a monthly salary; or employed and earning a weekly or other wage. In practice the completed schedules for Scotland, after scrutiny by the local registrars, were scrutinised by members of the General Registry Office of that country. As regards the schedules for England and Wales initial scanning suggested that, in about 5 per cent. of cases, there were errors in the coding of either social class or marital condition. To reduce this error, some 500,000 schedules were therefore scrutinised and corrected in London; and an arrangement was made for the mechanical checking of errors in the coding of marital condition. Finally it was decided not to code by hand the fertility data given in the schedules (i.e. birth-intervals derived from the dates of birth of each live-born child) but to provide for mechanical coding. Dates of birth would be punched on the machine cards, and these would be sorted and the resultant birth-intervals gang-punched by the use of a pack of master-cards covering all the probable combinations of dates.

The Response of Women drawn in the Sample

Since it was not possible to invoke the powers of the 1920 Census Act, the success of the Family Census depended upon the extent to which the women drawn in the sample were prepared to co-operate in giving the information required. The need to minimise refusals affected the inquiry in three main ways. First, it was necessary to restrict the schedule to the smallest number of questions compatible with the objects of the Census, and to present those questions as clearly and attractively as possible. It will be seen from the schedule reproduced in the Appendix that very few questions were asked, and those only

(1) For persons temporarily in the Armed Forces, the peace-time occupation was asked for. The census schedule is reproduced in Appendix 4 to the present paper.

questions of fact and involving, in the main, relatively little difficulty for the women concerned. The questions covered the date of birth of the woman; some details regarding her marriage or marriages; the dates of birth of every live-born child she herself had had (whether or not they were still alive at Census date); the occupation of her husband; and the number of her children under 16 years of age who were still alive at Census date. There is no doubt that, had the inquiry been carried out in different circumstances, it would have been of great value to ask many additional questions. At the same time, in order to prevent the schedule from looking too unattractive, it was, after being tested in two pilot inquiries, handed to a specialist in commercial lay-out who designed the final version.

Secondly, it was desirable to obtain favourable publicity for an investigation about which there was bound to be a good deal of public discussion. For this reason, two Press conferences were held, one in September 1945, to give the newspapers a general idea of the objects and nature of the inquiry, and the other immediately before the actual enumeration, intended to make quite clear the way in which the Census would be carried out, to emphasise that the information collected would be treated with the strictest confidence, and to point out that women would not be asked why they had had or had not had children, but only how many children they had borne. On the whole, the resultant publicity was not unfavourable, and the good effect of this was added to by B.B.C. talks describing the purpose of the Census and explaining how the Census schedules should be completed. On the other hand, there were some instances of unfavourable publicity given by national and local newspapers, and adverse comments were made by one or two M.P.s, arising largely from a misconception of what the Census was actually asking of women in the sample. Unfavourable publicity appears to be peculiarly effective, and the enumerators met with a number of resultant difficulties, added to by hostility to the government arising from the " dried eggs campaign ", which began halfway through the enumeration.(1) There were also some difficulties in finding women at home, in spite of the insistence that an enumerator had to leave a note and call at least three times before giving up and informing his supervisor that the particular woman was a " no-contact ". In parts of London, for example, some of the addresses were evidently only " accommodation addresses ", and the women could not be traced; there may even, indeed, have been cases of " non-existent " women, that is, of ration books obtained by fraud. In other cases, the " no-contacts " were really refusals, for the enumerators noted that the women were actually at home but refused to answer the door.

Thirdly, it had been anticipated that, despite the provision of at least three calls, a number of women would not be found at home. It had also been anticipated that some of the women who had refused to give completed schedules to the enumerators might nevertheless be willing to send them directly to the Royal Commission. Accordingly, local supervisors were asked to send to London complete lists of the names and addresses of all women who could not be found at their homes or who had refused to co-operate. Special explanatory letters and additional schedules were then sent to all those women, and they were invited to complete the schedules and return them, in the stamped addressed envelopes provided, directly to the Royal Commission. Over 17 per cent. of the women to whom a written appeal was made did actually

(1) The government had announced that dried eggs would no longer be available, and this gave rise to a considerable attack by the Press.

respond. The results of the enumeration for Great Britain as a whole are summarised in the following table:

TABLE 1

Great Britain: Response to the Family Census

	Total sample drawn (1)	Women found to be single (2)	Women who died before contact (3)	Final sample (4)	No. of forms completed (5)	No. of refusals (6)	No. of No-contacts (7)	Refusals Per cent. (8)*	No Contacts Per cent. (9)*
Original enumeration.	1,497,705	85,957	4,223	1,407,525	1,191,620	128,713	87,192	9·1	6·2
After postal follow-up.	1,497,705	86,156	4,231	1,407,318	1,229,816	177,502		12·6	

* These percentages are calculated with column (4) as denominator.

It will be seen that, before the postal follow-up, refusals and no-contacts together amounted to about 15·3 per cent. of the final sample,([1]) and that no-contacts accounted for about 40 per cent. of this total omission. After the follow-up, the total omission amounted to 12·6 per cent. In effective terms, therefore, the overall response to the Family Census was 87·4 per cent.([2])

The Question of Bias

For a purely voluntary inquiry, covering a cross-section of the whole community and allowing no substitutions, the response to the Family Census was high.([3]) Nevertheless the fact that a substantial proportion of women either

([1]) Since these percentages are based on the final sample (i e excluding single women and women who died before being contacted), they minimise the amount of co-operation given by the women concerned. The 86,000 single women listed above also co-operated by stating that they were single, while co-operation was given by other persons who stated that the women in question had died. If lack of co-operation is taken only as definite refusal, then women who did not co-operate even before the postal follow-up, amounted to only 9·1 per cent. of the final sample.

([2]) In Scotland it was 89·4 per cent. In reality, the response may be a little higher than these figures suggest, for it is not unlikely that among the women who even after the postal follow-up did not respond, there were some who were single. But it is not possible to confirm this, and thus the only known fact is that the response was *at least* as high as the figures above indicate.

([3]) The Family Census response may be compared with that for the U S. Census of 1940. In the latter Census, questions on fertility were asked of a sample of 5 per cent. of all the women covered. Taking those women who, at the time of the Census, were or had been married, 12·7 per cent. failed to report on the number of children ever born. Thus, even with compulsory powers, the overall response to the fertility questions was no higher than that obtained in the Family Census. It is also of some interest to examine the position of the well-known 1911 Fertility Census in England and Wales. The question there was not, however, one of failure or refusal to give information, but of the exclusion by the General Register Office of certain categories of women, namely all widows and all married women whose husbands were absent (for various reasons) at the Census date. Thus of the total number of ever-married women, only 75 per cent. were included in the analysis. This figure of 75 per cent. may therefore be regarded as the " response rate " to be compared with 87·4 per cent. for the Family Census. A detailed study of the " response rate " of the 1911 Census will be given in the full reports on the Family Census. It is, however, of some interest to note here that the exclusion of categories of women (and especially of widows) from the 1911 analysis means that the " response " falls rapidly as the analysis goes back in time. Thus, of the women who married in 1901–05 and (whatever their subsequent marital condition) were still alive in 1911, the 1911 Census analysis covers 91 per cent. But only 52 per cent. of the women married in 1871–75 and still alive in 1911 were covered by the analysis, and only 32 per cent. of those married in 1861–65 and still alive in 1911.

could not be found or would not co-operate, made it imperative to consider and, as far as possible, correct for bias resulting from failure to achieve a 100 per cent. response. Two lines of approach were followed: first, to compensate for regional variations in the response rate; and secondly, to examine, with the help of such independent data as were available, how far the fertility characteristics of the women actually covered by the Census deviated from those of the true universe of ever-married women.

The first approach involved a detailed study of the response rates by geographical area and by the size of the samples originally drawn in the various Food Offices. Analysis of variance showed that, for Food Offices within the same geographical area, or within the same group of sample size, there was a much more uniform behaviour in response rates than for Food Offices in the country as a whole. On the basis of this analysis it was decided to compensate for regional variation by standardising the response for all Food Office areas at a common rate of 87·5 per cent. The method followed was to calculate, for each Food Office area, the extent to which the number of schedules needed to be increased or diminished to arrive at that common rate. The calculation having been made, the process was carried out with the punched cards, and the selection of cards for duplication or withdrawal was made by drawing pairs of digits from tables of random numbers, and duplicating or rejecting cards, the serial numbers of which ended in those digits. This approach could not, however, do more than give each area its correct weight in the material for the whole country. It could not compensate for the fact that, for Great Britain as a whole, some of the women in the final sample did not complete census forms.

As regards this latter question, it is difficult to find appropriate independent data with which the Family Census results can be compared. This is not surprising, for the Census was taken specifically to provide information not otherwise available. Nevertheless, various tests were possible, and two of them will be discussed here.

First, since the analysis of the Census results was to be primarily in terms of marriage cohorts, it was important to estimate how far the Census was representative of the various cohorts. This could be done, in approximate terms, by analysing the annual marriage statistics of Great Britain and, by applying generation-life-table factors to women marrying for the first time at various ages and in the various years, calculating the numbers of such women who should have been alive at Census date, irrespective of their marital condition at that date. With a 100 per cent. response, the Family Census should have covered one-tenth of the survivors of each of the relevant cohorts, and the difference between the expected and actual representation in the Census would thus give an index of the response rate for the various cohorts. This estimate would not, however, take migration into account and would tend to underestimate the response rate of the Census. A second method was therefore adopted, deriving survival factors not from generation-life-tables, but by taking, say women (irrespective of marital condition) aged 15–19 years at one census and tracing the survivors of this group at the corresponding ages in each subsequent census. Survival factors of this kind, allowing for mortality and migration (assuming, however, that the chances of migrating bore equally upon women of all marital conditions), were then applied to the relevant first marriages by age and the results used as in the first method. The data and conclusions are summarised in Table 2. Since the overall response to the Family Census was at least 87·4 per cent., even Column (8) in the table appears to understate the response rates of the various cohorts. The main understatement may perhaps lie in the earliest cohorts of marriages, for which

the annual marriage statistics are least satisfactory.(1) It should also be explained that the response rate for the 1941–45 cohorts is depressed by the specially low response rate for the cohort of 1945. This, the most recent crop of marriages covered by the Census, was particularly underrepresented, and only 57·6 per cent. of the quota of expected survivors were covered by the Census.(2) The rate for the period 1941–44 was 81·7 per cent.

Having obtained an estimate of the response rate for the various cohorts, the next stage was to ascertain how far incomplete response was associated with bias in the fertility of the women actually covered by the Census. A detailed study of this question is possible only for the most recent cohorts of marriages

TABLE 2

Great Britain: Expected and Actual Survivors at Census Date of First Marriages (under 45 Years of Age only) contracted in Various Periods between 1880 and 1946

Date of first marriage	First marriages originally contracted	First marriages recorded in family census	Expected survivors at census date (per cent.)		First marriages recorded in family census as per cent. of [Col. (2) × 0 1]	Family census response (per cent.) assuming survival rates of	
			Excluding migration	Including migration		Col. (4)	Col. (5)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1880–99	4,501,283	101,585	31·5	30·7	22·6	71·7	73·6
1900–10	3,011,978	170,334	67 9	63·6	56·6	83·4	89·0
1911–15	1,515,945	106,233	80·4	76·6	70·1	87·2	91·5
1916–20	1,554,162	116,785	86·4	83·3	75·1	86·9	90·2
1921–25	1,527,349	127,454	91·1	88·8	83·4	91·5	93·9
1926–30	1,556,966	131,615	94·3	93·1	84·5	89·6	90·8
1931–35	1,685,007	142,889	96·4	96·3	84·8	88·0	88·1
1936–40	2,059,823	176,507	98·2	98·2	85·7	87·3	87·3
1941–45	1,796,371	136,318	99·5	99·5	75 9	76·3	76·3
1880–1945	19,208,884	1,209,720	74 5	72·8	63·0	84·6	86·5

—that is, marriages taking place in the period 1938–45—for which cohorts an independent check can be derived from the material collected under the Population (Statistics) Act. At the same time, it is for these cohorts that the Census response is least complete, so that a check based upon them may, in a sense, be regarded as critical. The check was devised in the following way. The Census results were used to construct a table showing, for women married for the first time (at any age) in 1938 and subsequent years, total reproductive

(1) That is, ages at marriage are not given for a proportion of the women, amounting to 9·9 per cent. of the first marriages in England and Wales in 1880–89, and 1·9 per cent. in 1890–99. These unstated ages were distributed *pro rata* in the calculations. But as it is not unlikely that it was the older women for whom the ages were unstated, the effect of *pro rata* distribution would be to overestimate the number of survivors at Census date of the first marriages of those periods, and thus underestimate the Family Census response for the relevant cohorts. Another difficulty as regards the early cohorts is that the survivors would be very old by Census date and that it is just for the older ages that age data given in the censuses and at death registration are likely to be least accurate.

(2) This was due in part to the method of sampling. Women marrying after the exchange of ration books in 1945 would be caught in the sample only if they had changed the surname given in their ration books and it is very likely that a substantial number had not made this change by January, 1946. There may also have been some ante-dating of marriage in order to conceal pre-marital conceptions.

performance by Census date, expressed in terms of the extent of childlessness, the average number of live births per woman, and the average number of live births per fertile woman. The material collected under the Population (Statistics) Act was then used to construct a table as near as possible comparable with that derived from the Family Census.[1] The results are shown in Table 3 below. Three points are brought out by the table:

TABLE 3

Great Britain: Childlessness (per cent.) and Average Family Size by Census Date as Estimated from National Vital Statistics and as given by Family Census

Date of first marriage	As estimated from vital statistics			As given by Family Census			Ratios		
	Per cent. childless	No. of live births per woman	No. of live births per fertile woman	Per cent childless	No. of live births per woman	No. of live births per fertile woman	Col. (5) / Col. (2)	Col. (6) / Col. (3)	Col. (7) / Col. (4)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1938	23·3	1·331	1·740	21·7	1·396	1·783	0·931	1·049	1·025
1939	27·9	1·142	1·589	25·5	1·212	1·628	0·914	1·061	1·025
1940	32·4	0·975	1·446	30·1	1·040	1·488	0·929	1·067	1·029
1941	33·9	0·890	1·354	34·4	0·910	1·388	1·015	1·022	1·025
1942	43·4	0·706	1·252	40·1	0·764	1·276	0·924	1·082	1·019
1943	44·8	0·629	1·146	44·1	0·652	1·166	0·984	1·037	1·017
1944	61·6	0·410	1·073	56·7	0·466	1·076	0·920	1·137	1·003
1945	91·6	0·088	1·042	86·8	0·147	1·110	0·948	1·670	1·065

(1) The Family Census underestimates the extent of childlessness. For the whole period under consideration (taking an unweighted average), the Family Census yields a figure for childlessness which is 94·6 per cent. of the figure derived from the national vital statistics.

(2) The Family Census overestimates the average number of children per woman, and especially for the marriages of 1944 and 1945.

(3) But the overestimation in (2) is due primarily to the understatement of childlessness and not to any substantial extent to an overstatement of the fertility of fertile women. In fact, the two sets of data give remarkably similar results for the average fertility of fertile women. Taking into

[1] To do this meant estimating the numbers of survivors, year by year to Census date, of the first marriages from 1938 to 1945 inclusive; translating first and other order births at specific marriage durations into births attributable to marriages contracted in various calendar years; and making assumptions regarding the extent to which first births occur to first and subsequent marriages. Two estimates were made: (*a*) assuming that first births occur only to first marriages and (*b*) assuming that subsequent marriages have the same chance of yielding first births for each age and for each duration of marriage as do first marriages. These two estimates may be regarded as setting the upper and lower limits. But in estimating childlessness, it is clear that, because of previous exposure to risk of childbearing, it is most unlikely that subsequent marriages have the same chance, for comparable ages and marriage durations, of bearing first children as do first marriages. Thus, when choosing a single figure for childlessness, a point was taken above the lower limit, at one-third of the distance between the lower and upper limits. In estimating the average number of children per woman, however, this argument does not apply, so the single figure chosen was midway between the lower and upper limits. In general, it should be emphasised that the range between the two estimates of average family size was not, in any case, greater than about 3 per cent.

account the possibilities of mis-statements in both the vital and Family Census statistics, and the difficulties involved in attempting to construct comparable tables, it is doubtful, if, save possibly for the 1945 marriages, the differences under this head between the two sets of results are really significant.

How far this understatement of childlessness affects the general validity of the main Family Census results naturally depends on the extent of childlessness in the cohorts under consideration. The cohorts examined in Table 3 are all very recent and thus bound to show a rather high proportion of childlessness. For previous cohorts, however, with longer marriage duration (quite apart from the question of the actual pattern of fertility of those earlier cohorts), the effect is much smaller. Consider, for example, women married for the first time in 1930. According to the Family Census, those women had an average of 1·704 live births by the tenth year after marriage, and an average of 2·096 live births per fertile woman, while 18·7 per cent. of the women were still childless by that date. Assume that the understatement of childlessness was at the highest point shown in the analysis of the marriages of 1938–45 —that is, 91·4 per cent. of " true " childlessness, as shown in Table 3 for the marriages of 1939. Then the " true " childlessness would amount to 20·5 per cent., and the " correct " average number of live births per woman would be 1·666. If the latter were correct, the Family Census would overestimate the average number of live births per woman by only 2·3 per cent. The exaggeration would be still less if the relative amount of understatement of childlessness were that shown by the average of the results for the marriages of 1938–45. In that case the exaggeration would amount to only 1·4 per cent. It would also be less for the earlier marriage cohorts, with a lower level of childlessness. Thus, judging from the position of the marriage cohorts of 1938–45, for which cohorts the Census response was lower than the average, the degree of understatement of childlessness would not seriously affect the study of long-term trends in fertility. It would interfere with the examination of short-term trends if the variations in fertility rates were small, and this would apply equally to a comparison of any sets of closely similar rates. On the other hand, it might of course be argued that where rates do not differ by more than 2 or 3 per cent., it is often difficult to draw firm conclusions from such differences.

A further question arose. For the marriages of 1938–45 it would be possible to correct for the Census bias against childlessness by using the results of the estimates based on the national vital statistics. Was there any way of obtaining correction factors for the earlier cohorts of marriages? In considering this question, it seemed desirable to examine the fertility characteristics of those women who, while not co-operating in the actual enumeration, nevertheless responded to the follow-up appeal. Cards relating to the first 12,000 of those women were reproduced and analysed separately, with particular reference to the extent of childlessness and to the average number of live births born per fertile woman by Census date. Since these women formed part of what was, at least initially, the universe of no-contacts and refusals, it seemed very likely that their fertility characteristics would be different from those of the generality of women covered by the Census. What was of far greater interest was how the fertility characteristics of the " follow-up " women would compare with those of the women entirely omitted from the Census. To answer this question meant, in addition, estimating the extent of childlessness among women omitted from the enquiry, and this was done for the women married between 1938–45. The method used may be shown by the following example. It had been estimated that the Census response for the marriages of 1938 was about 87·9 per cent. (that is, the Census covered only 8·79 per cent. of the survivors instead of the 10 per cent. who should have been covered). For that marriage

cohort, the Family Census showed 21·7 per cent. childlessness by Census date instead of a " true " childlessness of 23·3 per cent. according to the estimates derived from the national vital statistics. Thus to yield the " true " childlessness for all the women who should have been covered by the Census, childlessness among the missing women must have been $\frac{23\cdot3\ (100)\ -\ 21\cdot7\,(87\cdot9)}{(100 - 87\cdot9)}$, or 34·9 per cent. This kind of calculation was done for all the marriage cohorts of 1938–45. Since, however, earlier analysis suggested that there had been some transference of birth or marriage data from year to year by women covered by the Census (producing a kind of " saw-tooth " effect in the fertility rates), the results are given for pairs of years. They are shown in Table 4, which compares them with the rates obtained by examining the fertility of the " follow-up " women. In spite of discrepancies in individual cases, the two series show a striking general similarity.

TABLE 4

Great Britain: Percentage of Childlessness among " Follow-up " Women and among Women omitted from Census

Date of first marriage (1)	Among " Follow-up " women (per cent.) (2)	Calculation of childlessness among women omitted from the Census (per cent.) (3)
1938–39 ...	36·6	39·9
1940–41 ...	43·6	37·9
1942–43 ...	54·5	53·6
1944–45 ...	78·2	86·1

Indeed, bearing in mind the fact that the calculated percentages relate only to women *omitted* from the Census, it is evident that if the missing proportion were weighted by the percentages in Column (2), the results for all marriages would be very close to the " true " percentages derived from the national vital statistics.

That this is the case is shown in Table 5(1).

TABLE 5

Great Britain: Overall Percentages of Childlessness by Census Date of First Marriages taking place in 1938–45

Date of first marriage (1)	Calculated by combining census results with data for " follow-up " women (per cent.) (2)	" True " percentages derived from the national vital statistics (per cent.) (3)	Col. (2) as per cent. of Col. (3) (4)
1938–39	25·2	25·6	98·4
1940–41	34·1	33·2	102·7
1942–43	44·3	44·1	100·5
1944–45	73·9	76·6	96·5

It is important in this context that while the " follow-up " cases show a substantially higher childlessness than the generality of women in the Family Census as a whole (the differences are all, save that for the 1945 marriages, significant at the 5 per cent. point), the differences in the fertility of the fertile women between the two series are small, as may be seen from the following table.

(1) The results in Col. (2) of Table 5 are obtained in the following way. For the marriages of 1938–39, for example, the Family Census, with a response of about 87·7 per cent., shows 23·6 per cent. childlessness, while the " follow-up " women show 36·6 per cent. The overall childlessness is thus 0·877 (23·6) + 0·123 (36·6), or 25·2 per cent.

TABLE 5A

Number of Live Births per Fertile Woman

Date of first marriage	(a) Family Census as a whole	(b) " Follow-up " Cases
1938	1·783	1·824
1939	1·628	1·605
1940	1·488	1·448
1941	1·388	1·462
1942	1·276	1·308
1943	1·166	1·242
1944	1·076	1·111
1945	1·110	1·178

None of these differences is significant at the 5 per cent. point, though the averages in column (*b*) are fairly consistently higher than those in column (*a*). This result does not conflict with the observation already made that the bias in the Family Census is primarily one relating to childlessness and not to the fertility of fertile women.

The results given in Tables 4 and 5 suggest that this technique of using the information relating to the " follow-up " women might profitably be employed for the marriage cohorts prior to 1938, for which no independent correcting factor can be obtained from the material collected under the Population (Statistics) Act. It is at least of interest to see if the results thereby obtained are in agreement with the previous suggestion that the effect of bias against childlessness would not seriously affect the validity of the Census results for the study of long-term trends. The position may be illustrated by taking four separate cohorts of marriages. In this case the statistics relate only to first marriages still in existence at Census date or, if not, which had not terminated until the women in question were over 45 years of age. This more restricted group has been chosen in order to simplify the analysis. At the same time in order to include a relatively recent cohort, the analysis is directed to the position after 10 years' duration of marriage, thus making it possible to include the 1935 cohort.

TABLE 6

Great Britain: Childlessness (per cent.) per Marriage, by 10 Years after Marriage for Specified Marriage Cohorts (Marriages in existence at Census date or having ended when the women in question were over 45 years of age)

Date of first marriage	As given by Family Census	As shown by " follow-up " women	Adjusted Childlessness		
			(a) Assuming Family Census childlessness to be 91·4 per cent. of " true " percentage	(b) Assuming Family Census childlessness to be 94·6 per cent. of " true " percentage	(c) By combining Family Census percentage with percentage for " follow-up " women
(1)	(2)	(3)	(4)	(5)	(6)
1910	13·4	13·9	14·7	14·2	13·5
1920	15·5	19·5	17·0	16·4	15·9
1930	18·7	24·5	20·5	19 8	19·2
1935	18·6	28·7	20·4	19·7	19·8

In Table 6, the results in column (6) have been arrived at by combining the childlessness percentages of the Family Census and the " follow-up " women in the proportions of the response rate and the non-response rate for the cohorts concerned. On this method the results do, in fact, suggest that the bias against childlessness diminishes with the earlier cohorts of marriages, a not unlikely tendency, since, for example, it would be especially the *young* married women with no children who were most difficult for the enumerators to find at home. Similarly, it is not unlikely that the *younger*, childless married women would be more reluctant to record their childlessness. For the older married women, their childlessness would be an event of the past, possibly regarded as less subject to community disapproval and perhaps also more due to involuntary factors than in the case of younger women.

TABLE 7

Great Britain: Average Number of Live Births per Marriage after 10 Years' Duration Family Census and " Adjusted " Results

Date of first marriage	As given by Family Census	Adjusted on basis of Table 6			Ratios (per cent.)		
		(a)	(b)	(c)	Col. (2) / Col. (3)	Col. (2) / Col. (4)	Col. (2) / Col. (5)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1910	2·270	2·236	2·249	2·267	101·5	100·9	100·1
1920	2·026	1·990	2·005	2·017	101·8	101·0	100·4
1930	1·704	1·666	1·681	1·694	102·3	101·4	100·6
1935	1·688	1·652	1·667	1·665	102·2	101·3	101·4

The " adjusted " results given in Table 7 show the effects on the statistics of average numbers of live births per marriage of the various corrections discussed. Once again they underline the relatively small difference made, so far as the four cohorts of marriage are concerned, by the understatement of childlessness. In particular they show that the most suggestive method of correction, that based upon the " follow-up " women, produces " adjusted " results which differ so little from the uncorrected Census results that they give strong support to the view that, for all major purposes of historical analysis, the Family Census data provide a reliable basis. At the same time, the " follow-up " data offer a reasonable method of adjustment of the Census results.

The Tabulation of the Census Data

The Census results were, of course, tabulated mechanically. The actual design of the Hollerith card and of the tabulation process was conditioned by the shortage of machine capacity in the country. Briefly, the design had to be applicable to the lowest common denominator of machines available. In particular certain summary processes, which could easily have been carried out by modern tabulators, had to be done manually, adding greatly to the time required.

The Hollerith card itself was a standard 80 column card. Rather more than half the columns (columns 36–80) were punched with information taken directly from the Census schedule. Columns 1–31 were punched with coded information, showing the mother's age at marriage, the intervals between marriage and births of various orders, and the intervals between successive births. Because of the limited number of columns available, one or more

" trailer-cards " had to be used where the women concerned had more than 7 children. The first " trailer-card " covered the eighth to twelfth children; the second covered the thirteenth to seventeenth; and the third " trailer-card " covered the eighteenth to twenty-second children. The highest number of live born children borne by a woman included in the Census was 29. This was a unique case. But the subsequent tables show that, especially for the earlier cohorts, large families in general were found in substantial numbers, and many " trailer-cards " were required.

The actual tabulation programme included two main tables required for the work of the Royal Commission. The first, corresponding approximately to the kind of table derived from the 1911 Fertility Census, showed the total number of live births occurring by Census date to each woman enumerated, distinguishing calendar year of marriage and age at marriage. Though involving a great deal of work, including the aggregation of the separate social classes, this table was relatively straightforward. The second table was, however, the more important. It was designed to trace throughout marriage each group of women of a particular social class and married at a particular age in a particular year. It was this table which would yield distributions of family size (in terms of total numbers of live births occurring to each woman) at the end of each segment of married life, and thus make use of the special information collected by the Family Census.

The preparation of this second table was complex, involving much manual separation and aggregation, as well as some adjustment to overcome obvious inconsistencies in the data. The process is illustrated below for one cohort, namely women marrying in 1920 at ages 20–22½ years. In considering the illustration it should, however, be remembered that the tables given are already highly condensed, being derived from the separate tabulations for each of the ten social classes.

Table 8 shows the first stage of preparation. The data tabulated were intervals between marriage and various orders of birth. The kind of adjustments necessary may also be seen. Thus Table 8 shows 2 fourth births, 1 sixth birth and 1 eighth birth taking place before marriage, in contrast to only one pre-marital third birth. This was clearly impossible. The practice followed in such cases was to transfer the " impossible births " forward to the earliest time periods in which they could consistently have occurred. Thus one of the pre-marital fourth births was transferred to duration 0; the sixth pre-marital birth was transferred to duration 4; and the two eighth births from the pre-marital and 2 durations were transferred to duration 7. Births of unknown duration were distributed *pro rata* within the relevant birth order categories. The process is semi-automatic. At the same time it is clear that, while making for consistency, it cannot in any appreciable way affect the results.

With Table 8 as a basis, Table 9 was next prepared, by cumulating the data in the former table. The result is to show in the new table the number of women who, at any specified duration of marriage, have had more than a given number of children.

The next stage was to obtain the complete distribution of family size (in terms of live births). To do this involves adding to Table 9 the women who, according to the first main tabulation referred to previously, had had no live births by Census date. For the cohort in question, the tabulation showed 371 such women. They were added to the data of Table 9, and Table 10

TABLE 8

Fertile Marriages: Births taking Place within the x'th Year of Marriage to Women Marrying in 1920 at Ages 20–22½ Years

Birth Order	Pre-marital	Duration of marriage (years)																											Totals
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Unknown	
1	173	2415	1871	508	251	145	95	63	39	28	13	15	15	13	6	4	10	4	3	4	1	1	2	2	—	—	—	1	5,682
2	12	60	451	1106	966	598	429	298	212	142	125	83	63	47	29	37	27	9	14	8	12	2	4	4	1	2	—	3	4,744
3	1	4	16	90	343	532	487	403	330	229	173	127	110	111	87	52	58	50	29	24	16	8	8	5	6	1	—	2	3,302
4	2	—	1	5	31	104	197	260	281	242	208	178	123	114	97	83	47	51	43	37	25	14	9	11	6	4	—	1	2,174
5	—	—	—	—	2	6	31	71	108	175	150	155	125	116	100	74	74	59	34	29	28	23	15	15	8	7	1	—	1,406
6	1	—	—	—	—	—	4	10	33	45	66	89	92	100	85	97	62	54	50	37	36	18	22	14	10	3	4	—	932
7	—	—	—	—	—	—	—	1	4	17	22	27	54	43	65	58	57	56	41	39	35	27	15	8	9	5	2	1	586
8	1	—	—	1	—	—	—	1	—	2	11	9	16	29	30	35	49	26	31	35	35	22	21	11	3	4	1	1	374
9	—	—	—	—	—	—	—	—	—	—	1	—	3	7	10	7	15	34	22	29	21	11	15	21	7	5	5	1	214
10	—	—	—	—	—	—	—	—	—	—	1	—	2	4	4	11	5	10	15	19	23	14	11	6	5	2	—	—	132
11	—	—	—	—	—	—	—	—	—	—	—	—	1	—	2	2	6	5	3	6	10	8	7	8	2	3	2	—	65
12	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3	5	4	—	4	4	4	2	4	1	1	—	32
13	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	4	1	—	—	1	1	—	—	—	9
14	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	2	—	—	1	—	—	5
15	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	2	1	—	—	—	4
16	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1

TABLE 9

Fertile Marriages: Cumulation of Table 8

Duration of marriage (years)	Birth order															
	1+	2+	3+	4+	5+	6+	7+	8+	9+	10+	11+	12+	13+	14+	15+	16+
At marriage	173	12	1	1	—	—	—	—	—	—	—	—	—	—	—	—
1	2,588	72	5	2	—	—	—	—	—	—	—	—	—	—	—	—
2	4,460	523	21	3	—	—	—	—	—	—	—	—	—	—	—	—
3	4,968	1,630	111	8	2	1	—	—	—	—	—	—	—	—	—	—
4	5,219	2,597	454	39	8	1	—	—	—	—	—	—	—	—	—	—
5	5,364	3,195	987	143	39	5	—	—	—	—	—	—	—	—	—	—
6	5,459	3,624	1,474	340	110	15	1	1	—	—	—	—	—	—	—	—
7	5,522	3,922	1,877	600	218	48	5	3	—	—	—	—	—	—	—	—
8	5,561	4,135	2,207	881	393	93	22	5	—	—	—	—	—	—	—	—
9	5,589	4,277	2,436	1,124	543	159	44	16	1	1	—	—	—	—	—	—
10	5,602	4,402	2,610	1,332	698	248	71	25	1	1	—	—	—	—	—	—
11	5,617	4,485	2,737	1,510	823	340	125	41	4	3	1	—	—	—	—	—
12	5,632	4,548	2,847	1,633	939	440	168	70	11	7	1	—	—	—	—	—
13	5,645	4,595	2,958	1,747	1,039	525	233	100	21	11	3	—	—	—	—	—
14	5,651	4,624	3,045	1,844	1,124	622	291	135	28	22	5	—	—	—	—	—
15	5,655	4,661	3,097	1,927	1,187	684	349	184	43	27	11	3	—	—	—	—
16	5,665	4,688	3,155	1,974	1,246	738	405	211	77	37	16	8	—	—	—	—
17	5,669	4,697	3,205	2,025	1,280	788	446	242	99	52	19	12	2	—	—	—
18	5,672	4,711	3,234	2,068	1,309	825	485	277	129	71	25	12	6	1	—	—
19	5,676	4,719	3,258	2,105	1,337	861	520	312	150	94	35	16	7	2	—	—
20	5,677	4,731	3,274	2,130	1,360	879	547	334	161	108	43	20	7	2	1	—
21	5,678	4,733	3,282	2,144	1,375	901	562	355	176	119	50	24	7	4	1	—
22	5,680	4,737	3,290	2,153	1,390	915	570	366	197	125	58	26	8	4	3	—
23	5,682	4,741	3,295	2,164	1,398	925	579	369	204	130	60	30	9	4	4	—
24	5,682	4,742	3,301	2,170	1,405	928	584	373	209	132	63	31	9	5	4	—
Census	5,682	4,744	3,302	2,174	1,406	932	586	376	214	132	65	32	9	5	4	1

TABLE 10

Number of Marriages having yielded given Numbers of Live Births by Specific Durations

Duration of marriage (years)	All marriages: Numbers of live births																	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
At marriage	5,880	161	11	—	1	—	—	—	—	—	—	—	—	—	—	—	—	6,053
1	3,465	2,516	67	3	2	—	—	—	—	—	—	—	—	—	—	—	—	6,053
2	1,593	3,937	502	18	3	—	—	—	—	—	—	—	—	—	—	—	—	6,053
3	1,085	3,338	1,519	103	6	1	1	—	—	—	—	—	—	—	—	—	—	6,053
4	834	2,622	2,143	415	31	7	1	—	—	—	—	—	—	—	—	—	—	6,053
5	689	2,169	2,208	844	104	34	5	—	—	—	—	—	—	—	—	—	—	6,053
6	594	1,835	2,150	1,134	230	95	14	—	1	—	—	—	—	—	—	—	—	6,053
7	531	1,600	2,045	1,277	382	170	43	2	3	—	—	—	—	—	—	—	—	6,053
8	492	1,426	1,928	1,326	488	300	71	17	5	—	—	—	—	—	—	—	—	6,053
9	464	1,312	1,841	1,312	581	384	115	28	15	—	1	—	—	—	—	—	—	6,053
10	451	1,200	1,792	1,278	634	450	177	46	24	—	1	—	—	—	—	—	—	6,053
11	436	1,132	1,748	1,227	687	483	215	84	37	1	2	1	—	—	—	—	—	6,053
12	421	1,084	1,701	1,214	694	499	272	98	59	4	6	1	—	—	—	—	—	6,053
13	408	1,050	1,637	1,211	708	514	292	133	79	10	8	3	—	—	—	—	—	6,053
14	402	1,027	1,579	1,201	720	502	331	156	107	6	17	5	—	—	—	—	—	6,053
15	398	994	1,564	1,170	740	503	335	165	141	16	16	8	3	—	—	—	—	6,053
16	388	977	1,533	1,181	728	508	333	194	134	40	21	8	8	—	—	—	—	6,053
17	384	972	1,492	1,180	745	492	342	204	143	47	33	7	10	2	—	—	—	6,053
18	381	961	1,477	1,166	759	484	340	208	148	58	46	13	6	5	1	—	—	6,053
19	377	957	1,461	1,153	768	476	341	208	162	56	59	19	9	5	2	—	—	6,053
20	376	946	1,457	1,144	770	481	332	213	173	53	65	23	13	5	1	1	—	6,053
21	375	945	1,451	1,138	769	474	339	207	179	57	69	26	17	3	3	1	—	6,053
22	373	943	1,447	1,137	763	475	345	204	169	72	67	32	18	4	1	3	—	6,053
23	371	941	1,446	1,131	766	473	346	210	165	74	70	30	21	5	—	4	—	6,053
24	371	940	1,441	1,131	765	477	344	211	164	77	69	32	22	4	1	4	—	6,053
Census Date.	371	938	1,442	1,128	768	474	346	210	162	82	67	33	23	4	1	3	1	6,053

It may be seen from the above that, because of the complexity of the material, the process of preparing tables has been rather different from that sufficient for an ordinary fertility census. In fact, so far as the Family Census is concerned, the tabulation sheets represented a very elementary stage in the procedure. It was after the tabulation sheets were available that the major work began, and the apparently simple tables given in the next section have involved very considerable labour in aggregation, computation and verification, followed by still more work in standardising the results and in correcting them for the understatement of childlessness by the Census.

Some Basic Tables

This section presents a number of basic tables derived from the Family Census results. The object has been to show, in particular, what new types of analysis are possible with an investigation which asked not only the total number of live births occurring to each woman, but also the date of birth of each liveborn child. At the same time the tables presented here are those from which excerpts and generalisations are given in the Royal Commission's report. In considering the tables, two points should be noted. First, they refer only to what may be called " continuing marriages ", defined as marriages still in existence at Census date (i.e., both partners still alive then) or, if dissolved, in which dissolution did not occur until the wives were over 45 years of age. Thus, for these marriages the only factors determining the length of that part of the reproductive period spent in the married state, are the date of and age at marriage. The resultant distributions, averages and rates are therefore " gross " results in that no allowance is made for mortality or divorce. Secondly, the data used are provisional in that they have not all been matched and made fully consistent between themselves. In the main this is because many of the tables derive from summary tables produced in the process of tabulation and not from aggregating by hand the more detailed intermediate tables. This also has the result that the standardisation performed upon some tables could not be done upon others.

Some explanation is also necessary as regards the two types of adjustment used in producing the tables. First, allowance has been made for an understatement of childlessness by the Census. The methods used are those described in an earlier section. For the marriages of 1938–45 correcting factors have been derived from the national vital statistics. For earlier cohorts of marriage, the " follow-up " women have been used to provide such factors. It was, however, found that for the earliest cohorts of continuing marriages (1900–09), the " follow-up " cases showed slightly *less* childlessness than did the Census as a whole. Though there is nothing inherently impossible in that situation, no confirmatory evidence from other sources was available. At the same time the adjustment for those early cohorts, especially for long durations of marriage, resulted in " corrected " averages less than half of one per cent. different from the uncorrected averages. In the present account, therefore, the correction factor has not been used where it would result in a diminution of the childlessness given by the uncorrected figures. A more detailed discussion of the question will be given in the full reports on the Census.

Secondly, there is the problem of standardisation of age at marriage. Any tabulation of fertility census data by year of marriage involves a bias in that, in its representation of earlier cohorts of marriage, it is bound to cover a larger proportion of women marrying at young ages than would have obtained in the periods in which the marriages were actually contracted. This is simply the result of the different expectation of life of women marrying in the same calendar year but at different ages. Some correction is thus required, for

otherwise the fertility of the earlier marriage cohorts will be exaggerated. But what kind of correction is appropriate? Clearly that depends upon the object of the specific analysis being undertaken. If, for example, it were intended to show the trend of fertility free from the effects of variations in age at marriage, there might be some justification in standardising all data on the basis of a single table of marriage frequencies. In the present study, however, the object is to present gross fertility as affected by marriage—that is, regarding age at marriage as one of the factors influencing family size. For this reason, the standardisation chosen is multifold. The rates for each cohort are standardised on the basis of the actual age-distribution of first marriages for the year or years of marriage in question, as shown by the relevant annual marriage statistics for Great Britain. The effect of such a standardisation is to lower the fertility rates of the earlier, relative to the more recent, cohorts of marriages and thus to reduce the apparent decline in fertility over time.

The initial tables refer to marriages of completed fertility. For the purposes of this report, those marriages have been defined not by the age of the women at Census date but by the duration of marriage. A marriage of completed ferility is thus defined as one which has lasted, by Census date, for at least 20 years. This makes it possible to carry the picture of completed fertility up to and including the marriages of the year 1925. Since the terminal point used in all these cases is the Census date, the earlier cohorts of marriage have lasted for correspondingly longer periods. But this does not invalidate the general comparison, for the part played in the overall reduction in fertility between, say, the marriages of 1910 and 1925, by diminished duration of marriage is, in reality, very small. For example, the unstandardised average number of live births per woman for the marriages of 1910 is 3·09 at 25 years duration of marriage. The average for the marriages of 1925 is 2·19, and relates to marriages of 20 years duration. Strictly speaking, this latter figure should be compared with the 20 year duration average for 1910, which is 3·02. But the curtailment of 5 years duration for the marriages of 1910, reduces the fertility of that cohort by only about 2 per cent., which is very small compared with the fall in time between either 3·09 and 2·19 or 3·02 and 2·19. Moreover the effect upon later cohorts must be still smaller. Thus, in the tables dealing with completed fertility, which are cited merely to provide a general indication of patterns and trends, this not strictly accurate method suffices. In later tables, however, exactly comparable durations are given.

Table 11 gives the distribution of family size (in terms of total numbers of live births occurring during the reproductive period of the women concerned) for a series of marriage cohorts of completed fertility. These results are based on the ages at marriage as shown in the Census. They are also given on a standardised age basis (the basis already mentioned) in Table 12 for a few points in the series. In order to see the full implications of the change over time, the latter table should be read in conjunction with the corresponding data in Table 13, which gives the average number of live births per woman for whole series of cohorts. Thus between the cohorts of 1900–09 and 1925, the average number of live births per woman (standardised for age at marriage) fell from 3·37 to 2·21, or by about 34 per cent. (Col. (6) of Table 13). This fall was achieved primarily by the elimination of the larger families. As Table 12 shows, of the women married in 1900–09, almost 28 per cent. had 5 or more live births, while the comparable figure for women married in 1925 was only 11 per cent. Equally striking as an index of the change is the fact that women with 0, 1 and 2 live births comprised just under 45 per cent. of women marrying in 1900–09, but almost 67 per cent. of women marrying in 1925.

TABLE 11

Great Britain: Distribution of Family Size for Cohorts of Completed Fertility

Number of Marriages per 1,000, achieving various Numbers of Live Births by Census Date (1)

(A) Women marrying at under 45 years of age

Marriages per 1,000, with following numbers of live births by Census date:

Date of first marriage	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14+	Total
1900–09	103	142	183	157	121	86	65	48	34	24	17	9	6	3	2	1,000
1910...	118	166	202	169	111	76	55	36	25	17	11	7	4	2	1	1,000
1911...	123	178	215	154	113	75	50	33	23	15	9	6	3	2	1	1,000
1912...	124	184	209	162	107	71	51	35	22	15	10	5	3	1	1	1,000
1913...	122	183	214	166	106	71	51	33	21	13	10	5	3	1	1	1,000
1914...	127	178	222	165	111	68	46	31	19	13	8	5	3	2	2	1,000
1915...	140	206	234	161	98	62	37	23	16	10	6	3	2	1	1	1,000
1916...	152	207	233	155	96	58	37	22	16	10	7	3	2	1	1	1,000
1917...	155	200	234	160	97	57	39	23	14	9	5	3	2	1	1	1,000
1918...	148	208	233	156	100	60	35	23	15	9	6	3	2	1	1	1,000
1919...	140	200	228	158	102	63	39	26	18	10	8	4	2	1	1	1,000
1920...	139	215	235	161	97	57	35	24	15	9	6	3	2	1	1	1,000
1921...	143	227	246	154	90	52	33	21	13	7	6	4	2	1	1	1,000
1922...	149	237	252	150	83	50	30	17	12	8	5	3	2	1	1	1,000
1923...	153	242	251	146	84	47	31	19	12	7	4	2	1	1	—	1,000
1924...	157	249	249	144	83	45	27	18	11	7	5	2	1	1	1	1,000
1925...	164	249	251	143	78	46	28	19	10	6	4	1	1	—	—	1,000

(1) Corrected for understatement of childlessness but not standardised for age at marriage.

TABLE 11

Great Britain: Distribution of Family Size for Cohorts of Completed Fertility

Number of Marriages per 1,000, achieving various Numbers of Live Births by Census date(1)

(B) All Ages at Marriage

Marriages per 1,000, with following numbers of live births by Census date:

Date of first marriage	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14+	Total
1900–09	103	142	183	157	121	86	65	48	34	24	17	9	6	3	2	1,000
1910	120	166	201	169	111	75	55	36	25	17	11	7	4	2	1	1,000
1911	126	177	214	154	112	75	50	33	23	15	9	6	3	2	1	1,000
1912	126	184	208	162	107	71	51	35	22	15	10	5	3	1	1	1,000
1913	125	182	213	165	106	71	50	33	21	13	10	5	3	2	1	1,000
1914	131	177	221	164	110	67	46	31	19	13	9	5	3	2	2	1,000
1915	143	205	233	161	98	62	37	23	16	9	6	3	2	1	1	1,000
1916	156	206	232	154	95	58	37	22	16	10	7	3	2	1	1	1,000
1917	161	198	233	159	96	56	39	23	14	9	5	3	2	1	1	1,000
1918	155	207	231	155	98	60	34	23	15	9	6	3	2	1	1	1,000
1919	147	198	226	157	101	62	39	26	18	10	8	4	2	1	1	1,000
1920	146	213	233	160	96	56	35	24	15	9	6	3	2	1	1	1,000
1921	149	225	244	153	89	52	33	21	13	7	6	4	2	1	1	1,000
1922	156	235	249	149	83	49	30	17	12	8	5	3	2	1	1	1,000
1923	160	240	250	145	83	46	30	19	12	7	4	2	1	1	—	1,000
1924	163	246	247	143	83	45	27	18	11	7	5	2	1	1	1	1,000
1925	172	246	248	142	77	46	28	19	10	6	4	1	1	—	—	1,000

(1) Corrected for understatement of childlessness but not standardised for age at marriage

TABLE 12

Great Britain: Distribution of Family Size for Cohorts of Completed Fertility, Standardised for Age at Marriage, for Women Marrying at under 45 Years of Age

(Corrected for understatement of childlessness)

Marriages per 1,000 with following numbers of live births by Census date:

Total number of live births	Date of first marriage				
	1900–09	1910	1915	1920	1925
0	113	121	150	142	166
1	148	170	212	218	251
2	187	205	234	236	251
3	156	171	159	161	142
4	120	111	95	95	77
5	84	74	59	55	46
6	62	53	35	34	28
7	45	34	21	23	18
8	31	24	14	15	10
9	22	15	9	8	6
10	15	10	6	6	4
11	8	6	3	3	1
12	5	4	2	2	0
13	2	1	1	1	0
14 and over ...	2	1	0	1	0
Total... ...	1,000	1,000	1,000	1,000	1,000

TABLE 13

Great Britain: Average Family Size at Census Date (Number of Live Births per Woman) for Cohorts of Completed Fertility

Date of first marriage	Women marrying at under 45 years of age			Women marrying at all ages	Ratios for Column (4)	
	As given by Census	Standardised for age at marriage	Standardised and adjusted for childlessness	Standardised for age at marriage	Each Cohort as per cent. of (a) 1900–09 Cohort	Each Cohort as per cent. of (b) each previous Cohort
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1900–09	3·52	3·37	3·37	3·35	100	—
1910	3·11	3·03	3·03	3·01	90	90
1911	2·99	2·90	2·90	2·88	86	96
1912	2·96	2·88	2·88	2·86	85	99
1913	2·95	2·89	2·88	2·87	85	100
1914	2·89	2·81	2·81	2·79	83	98
1915	2·61	2·50	2·50	2·48	74	89
1916	2·57	2·50	2·50	2·48	74	100
1917	2·56	2·52	2·50	2 49	74	100
1918	2·58	2·53	2·52	2 50	75	101
1919	2·69	2·65	2·64	2·63	78	105
1920	2·58	2·53	2·52	2·50	75	95
1921	2·48	2·44	2·43	2·42	72	96
1922	2·38	2·34	2·33	2·32	69	96
1923	2·33	2·29	2·28	2·27	68	98
1924	2·29	2·25	2·25	2·23	67	99
1925	2·24	2·22	2·21	2·20	66	98

The survey of completed fertility stops short at the cohort of 1925. To bring the account more nearly up to date, it is necessary to deal with marriages for which the reproductive period is still incomplete. For this purpose, a marriage duration of 10 years has been chosen. By using that duration, it is possible to include marriages up to 1935. At the same time this period of married life is long enough to allow the larger proportion of all the probable or actual births to the marriage to occur(1). Thus the total fertility shown by the tenth year of marriage may be taken as an approximate indication of the general trend of fertility. The relevant data are given in Table 14. In this table the results refer to all ages at marriage and have not been standardised for age at marriage, since the detailed tables required for this standardisation are not available at the time of writing. But the standardisation factor is small, especially for the more recent marriages and the omission of this factor from Table 14 does not distort the general picture(2).

The total fall in fertility shown in Table 14 (Col. (4)) amounts to about 36 per cent. This in itself is not particularly significant, since the figures do not relate to the whole of the reproductive period of the women concerned. What is much more significant is the rate of fall from year to year. On this point Col. (5) shows the development of a rather stable position, beginning with the late 1920's. It would, in fact, appear that the various marriage cohorts of the 1930's had a closely similar fertility, perhaps the more remarkable in that for many of them, a substantial part of the 10 year duration fell within the war period. This stability may also be seen from the distribution of family size (total number of live births per woman) at 10 years duration, as given in Table 15. The latter table shows no marked weakening in the elimination of the larger families. But those families do not play an important part among the recent cohorts of marriage, so that even their complete elimination would have only a slight effect upon average family size. The figures also suggest that, at the level of the smaller families, there may have been some counter-balancing tendency among the most recent cohorts, in that the 2 and 3 child families were tending to become slightly more important as compared with the childless. But the tendency is far from definite, and the figures stop short at the point at which they begin to be interesting in this respect.

The statistics given in Tables 14 to 16 relate to a single segment of married life. But it is the special property of the Family Census that any segment of the married life of a given cohort can be compared with the corresponding segment for any other cohort. The kind of procedure enabling this to be done was described in the section on tabulation, and the results of such a procedure are given in Table 17. Once again, the beginnings of stabilisation may be seen in the fertility rates of marriages of the 1930's. This has occurred not in the early durations of marriage, but primarily in the medium durations, especially 7 to 11 years, suggesting that even though, at the time, economic and other circumstances may have caused couples to postpone having children during the early years of marriage, the numbers achieved after more extended married life were not very substantially affected. Nevertheless the figures do not show any sign of an upward movement in fertility, in spite of the rise in birth rates in recent years.

The gradual slowing down of the rate of decline for the medium durations of marriage may be seen by examining the data in a somewhat different way. In Table 18 the statistics have been so expressed as to show the position as it

(1) Cf Col. (3) and Col. (2) in Table 14.

(2) It was possible to carry out an indirect standardisation for the cohorts from 1900–09 to 1925 to verify this. It may also be substantiated by comparing Cols. (2) and (3) in Table 13.

would be observed in particular calendar years, instead of looking at particular cohorts of marriage. The basic material is the same as that used in Table 17, but it has been averaged and restated. Table 18 purports to show how many live births have been yielded, on the average, by a particular calendar year by marriages of a particular duration, and duration has here been defined as the number of years after the end of the calendar year in which the marriage took place. Thus to obtain, for example, the appropriate entries for the calendar year 1930, the duration of one year was obtained by averaging, in Table 17, the data for durations 1 and 2 for the cohort of 1929, duration 2 for the calendar year 1930 was obtained by averaging durations 2 and 3 for the cohort of 1928, and so forth. For the most recent calendar year it was also necessary to use the results as at Census date (not shown in Table 17) in order to obtain the appropriate figures. Thus, in Table 18, the rates for different durations in any calendar year refer to different cohorts of marriage and give the total reproductive performance of each cohort up to the specified point of time. The relevance of the table is that it makes it easier to see whether, in any series of calendar years, the various cohorts of marriage are showing changes in total fertility parallel to whatever changes in the birth rate may be taking place. In that context the stabilisation process is again evident in Table 18. But the figures also suggest that, as seen in 1945 and in spite of the rise in births during the latter part of the war, total fertility at the various durations of marriage was lower than as seen in 1938 or 1939. This was especially the case with the longer durations of marriage.

To summarise the analysis so far of the provisional results of the Family Census, the following points may be made:

(1) judged in terms of cohorts of completed fertility, there was a fall of more than 30 per cent. in the average number of live births per woman between the cohorts of 1900–09 and 1925;

(2) this fall in fertility involved the virtual elimination of the larger families;

(3) examination of the cohorts of incomplete fertility indicates a continuance of the fall among the more recent cohorts, but at a much slower rate and, indeed, with evidence of the beginnings of stabilisation. But it is only among the recent cohorts that this stabilisation appears.

(4) In spite of the rise in the birth rate in the latter part of the war, the figures do not suggest that, in 1945, marriages had borne more children than, at corresponding durations, had marriages in 1938 or 1939. On the contrary, total fertility at various durations in 1945 appeared to be below that in 1938 or 1939—slightly below for durations of marriage up to 10 or 11 years, and considerably so for longer durations.

In the report of the Royal Commission, reference is made to Family Census data on social class differences in fertility and it is therefore appropriate to give some further account of those data here. Once again it is necessary to emphasise the provisional nature of the statistics. In particular no adjustment has been made for childlessness, and that is a factor of substantial importance, especially for the upper socio-economic groups. The figures cannot therefore at present be regarded as more than illustrative and they are given only in summary form in Table 19. Only two class divisions are shown here, Class I consisting of the wives of professional workers, employers, workers on own account, salaried employees and non-manual wage-earners, and farmers and farm managers. All other married women were placed in Class II. The division is thus roughly between the non-manual and the manual population. It will be seen that for both the classes, the course of fertility is strongly similar, and

this bears on the question to which special interest is usually attached, namely whether the gap between the classes is diminishing. The figures in Table 19 do not suggest any lessening of the differences in fertility for the cohorts since 1910, except possibly at 10 years' duration of marriage. At this duration, there is some suggestion that the recent cohorts in Class I may have stabilised in fertility, while the fertility of those in Class II may have continued to fall. This would be a plausible development and might imply a rather smaller class difference in the future, especially because, as Lewis-Faning has shown, the spread of birth control among the working class has been rather more recent than among the middle class(1). At the moment, however, there is no evidence that this stability of Class I is other than a statistical product, due to the fact that the provisional figures have not been adjusted for understatement of childlessness. It would further be necessary to examine the data for all the medium durations of marriage to see whether, in general, they show the same apparent development. At present, therefore, all that can be said is that the figures in Table 19 do not offer any clear evidence of a decrease in the fertility differences between the social classes for the cohorts since 1910.

TABLE 14

Great Britain: Average Family Size (Number of Live Births) by Cohorts. All Ages at Marriage (Adjusted for Childlessness but not standardised for Age at Marriage)

Average family size			Ratios for Col. (2)	
Date of first marriage (1)	At 10 years marriage duration (2)	At census date (3)	Each cohort as per cent. of: 1900–09 cohort (4)	each previous cohort (5)
1900–09	2·51	3·51	100	—
1910	2·27	3·10	90	90
1911	2·22	2·98	88	98
1912	2·20	2·95	88	99
1913	2·20	2·93	88	100
1914	2·19	2·88	87	100
1915	2·01	2·60	80	92
1916	1·98	2·55	79	99
1917	2·00	2·53	80	101
1918	2·02	2·55	80	101
1919	2·11	2·66	84	104
1920	2·02	2·55	80	96
1921	1·94	2·44	77	96
1922	1·88	2·35	75	97
1923	1·83	2·30	73	97
1924	1·82	2·27	73	99
1925	1·77	2·20	71	97
1926	1·72	2·14	69	97
1927	1·70	2·10	68	99
1928	1·67	2·04	67	98
1929	1·65	2·02	66	99
1930	1·69	2·01	67	102
1931	1·64	1·92	65	97
1932	1·62	1·88	65	99
1933	1·60	1·79	64	99
1934	1·60	1·73	64	100
1935	1·61	1·67	64	101

(1) E. Lewis-Faning, *Report on an Enquiry into Family Limitation*, H.M.S.O., 1949.

TABLE 15

Great Britain: Distribution of Family Size (Number of Live Births) per 1,000 Marriages in Each Cohort at 10 Years' Duration of Marriage (Adjusted for Childlessness but not standardised for Age at Marriage). All Ages at Marriage

Date of first marriage	Marriages with following numbers of live births per 1,000 of all marriages in cohort concerned:									
	0	1	2	3	4	5	6	7	8	9+	Total
1900–09	118	175	235	199	148	85	30	7	2	1	1,000
1910	134	205	252	200	123	60	20	5	1	—	1,000
11	139	214	259	186	118	58	20	5	1	—	1,000
12	140	216	254	192	121	55	17	4	1	—	1,000
13	138	213	262	190	117	56	17	5	1	1	1,000
14	143	210	266	192	113	53	17	5	1	—	1,000
15	157	243	269	174	101	40	13	3	1	1	1,000
16	171	243	264	166	94	44	13	3	1	—	1,000
17	172	233	263	173	96	45	13	4	1	—	1,000
18	165	240	266	169	95	46	15	3	1	—	1,000
19	156	228	262	174	105	50	18	5	2	—	1,000
20	159	244	269	172	92	45	14	4	1	—	1,000
21	164	259	277	157	84	40	13	4	1	1	1,000
22	169	271	278	152	78	34	12	5	1	—	1,000
23	178	277	275	144	76	33	13	3	1	—	1,000
24	180	282	273	145	71	33	11	4	1	—	1,000
25	189	286	275	139	66	31	10	3	1	—	1,000
26	205	283	265	138	65	29	10	4	1	—	1,000
27	198	295	273	134	61	27	9	2	1	—	1,000
28	206	292	274	131	60	25	8	3	1	—	1,000
29	198	299	306	103	57	24	9	3	1	—	1,000
30	192	301	281	131	57	25	9	3	1	—	1,000
31	205	302	279	128	54	21	7	3	1	—	1,000
32	209	307	269	131	53	21	7	2	1	—	1,000
33	209	317	271	120	52	20	8	2	1	—	1,000
34	203	314	279	125	52	19	6	2	—	—	1,000
35	202	305	287	127	52	18	6	2	1	—	1,000

TABLE 16

Great Britain: " Split Averages " of Number of Live Births per Woman for Various Cohorts of Marriage, at Ten Years' Duration

(Adjusted for Childlessness but not standardised for Age at Marriage)

Date of first marriage (1)	Average number of live births per woman for women with 0 to 3 live births (2)	Women with 2 and 3 live births as per cent. of women with 0 to 3 live births (3)
1900–09	1·71	59·7
1910	1·65	57·1
1911	1·62	55·8
1912	1·62	55·6
1913	1·63	56·3
1914	1·63	56·5
1915	1·55	52·6
1916	1·50	50·9
1917	1·52	51·8
1918	1·52	51·8
1919	1·55	53·2
1920	1·54	52·3
1921	1·50	50·6
1922	1·47	49·4
1923	1·44	47·9
1924	1·44	47·5
1925	1·41	46·6
1926	1·38	45·2
1927	1·38	45·2
1928	1·37	44·9
1929	1·35	45·1
1930	1·39	45·5
1931	1·36	44·5
1932	1·35	43·7
1933	1·33	42·6
1934	1·35	43·9
1935	1·37	45·0

TABLE 17

Great Britain: Total Family Size (Number of Live Births per Woman) at Various Durations of Marriage, for Individual Cohorts (Adjusted for Childlessness but not Standardised for Age at Marriage). All Ages at Marriage

Date of first marriage	Duration of marriage in years																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1910	0·37	0·73	1·03	1·29	1·50	1·70	1·85	1·99	2·11	2·27	2·41	2·52	2·62	2·71	2·78	2·85	2·90	2·95	2·99	3·02	3·04	3·06	3·07	3·08	3·09
11	0·35	0·73	1·02	1·26	1·46	1·63	1·76	1·90	2·07	2·22	2·34	2·44	2·54	2·62	2·69	2·75	2·81	2·85	2·88	2·91	2·93	2·95	2·96	2·96	2·97
12	0·39	0·74	1·01	1·23	1·42	1·57	1·71	1·90	2·06	2·20	2·32	2·43	2·52	2·60	2·67	2·73	2·78	2·83	2·86	2·89	2·91	2·92	2·93	2·94	2·95
13	0·39	0·74	1·00	1·21	1·37	1·54	1·74	1·92	2·08	2·21	2·32	2·43	2·52	2·60	2·66	2·72	2·77	2·81	2·84	2·86	2·88	2·90	2·91	2·92	2·92
14	0·40	0·72	0·96	1·14	1·32	1·55	1·75	1·91	2·06	2·19	2·29	2·40	2·48	2·56	2·62	2·68	2·73	2·77	2·79	2·82	2·84	2·85	2·86	2·87	2·88
15	0·32	0·60	0·80	0·98	1·23	1·44	1·61	1·76	1·89	2·01	2·11	2·20	2·27	2·33	2·39	2·43	2·47	2·50	2·53	2·55	2·56	2·58	2·58	2·59	2·59
16	0·29	0·54	0·76	1·01	1·24	1·43	1·60	1·74	1·87	1·98	2·08	2·16	2·23	2·29	2·34	2·38	2·42	2·45	2·48	2·50	2·51	2·52	2·53	2·54	2·54
17	0·29	0·55	0·85	1·09	1·29	1·47	1·62	1·76	1·89	1·99	2·08	2·16	2·23	2·29	2·33	2·37	2·41	2·44	2·46	2·48	2·50	2·51	2·52	2·52	2·53
18	0·28	0·64	0·91	1·13	1·33	1·50	1·66	1·80	1·91	2·01	2·10	2·18	2·25	2·31	2·36	2·40	2·42	2·46	2·48	2·50	2·51	2·52	2·53	2·54	2·54
19	0·39	0·72	0·98	1·20	1·41	1·58	1·74	1·88	2·00	2·10	2·19	2·27	2·34	2·40	2·45	2·49	2·53	2·56	2·59	2·61	2·62	2·63	2·64	2·65	2·65
1920	0·36	0·70	0·95	1·17	1·36	1·53	1·68	1·80	1·92	2·02	2·10	2·18	2·24	2·30	2·35	2·39	2·43	2·45	2·48	2·50	2·52	2·53	2·54	2·54	2·55
21	0·37	0·68	0·93	1·14	1·32	1·48	1·62	1·74	1·85	1·94	2·02	2·09	2·15	2·21	2·25	2·29	2·33	2·36	2·38	2·40	2·41	2·42	2·43	2·44	
22	0·34	0·67	0·90	1·10	1·27	1·43	1·56	1·69	1·79	1·88	1·95	2·02	2·08	2·13	2·17	2·21	2·24	2·27	2·29	2·31	2·32	2·34	2·34		
23	0·35	0·65	0·88	1·08	1·25	1·40	1·53	1·65	1·75	1·84	1·91	1·98	2·03	2·09	2·13	2·17	2·20	2·23	2·25	2·27	2·28	2·30			
24	0·35	0·65	0·88	1·07	1·24	1·38	1·52	1·63	1·73	1·81	1·89	1·96	2·02	2·06	2·11	2·15	2·17	2·20	2·23	2·25	2·27				
25	0·35	0·64	0·85	1·04	1·21	1·36	1·48	1·59	1·68	1·76	1·84	1·91	1·96	2·01	2·05	2·09	2·12	2·15	2·17	2·19					
26	0·34	0·62	0·84	1·02	1·18	1·32	1·44	1·55	1·64	1·72	1·80	1·86	1·91	1·96	2·00	2·04	2·07	2·10	2·13						
27	0·34	0·61	0·82	1·00	1·16	1·30	1·42	1·52	1·62	1·70	1·77	1·84	1·89	1·94	1·98	2·01	2·05	2·08							
28	0·32	0·61	0·81	0·99	1·15	1·28	1·40	1·50	1·59	1·67	1·74	1·81	1·86	1·90	1·94	1·99	2·02								
29	0·33	0·60	0·81	0·98	1·13	1·26	1·37	1·46	1·56	1·65	1·72	1·79	1·84	1·89	1·94	1·99									
1930	0·32	0·60	0·81	0·99	1·14	1·29	1·41	1·52	1·61	1·69	1·76	1·82	1·88	1·93	1·99										
31	0·32	0·58	0·78	0·95	1·11	1·25	1·38	1·48	1·57	1·64	1·70	1·77	1·83	1·89											
32	0·32	0·58	0·78	0·95	1·11	1·25	1·37	1·47	1·55	1·62	1·69	1·77	1·84												
33	0·31	0·57	0·77	0·94	1·09	1·23	1·35	1·43	1·51	1·59	1·68	1·75													
34	0·30	0·56	0·76	0·94	1·09	1·22	1·32	1·41	1·51	1·60	1·69														
35	0·30	0·55	0·75	0·93	1·07	1·19	1·30	1·41	1·52	1·62															
36	0·29	0·54	0·74	0·91	1·04	1·16	1·28	1·40	1·51																
37	0·28	0·53	0·72	0·86	0·99	1·14	1·27	1·39																	
38	0·28	0·54	0·71	0·87	1·02	1·18	1·31																		
39	0·24	0·46	0·64	0·81	0·97	1·11																			
1940	0·21	0·43	0·61	0·78	0·93																				
41	0·22	0·47	0·66	0·83																					
42	0·21	0·44	0·62																						
43	0·27	0·53																							
44	0·26																								

The table should be interpreted in the following way. The line for 1910 shows the average number of live births per woman married for the first time in that year, at various durations, e g. 1·50 live births 5 years after marriage, 2·27 live births 10 years after marriage, etc. In this table, exact durations are given—e g exactly 10 years after marriage, etc.

TABLE 18

Great Britain: Total Number of Live Births per Married Woman at Various Durations of Marriage as observed in various calendar Years (Adjusted for Childlessness but not Standardised for Age at Marriage). All Ages at Marriage

Duration of marriage (years)*	Calendar year of observation															
	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945
1	0·47	0·46	0·45	0·45	0·44	0·43	0·42	0·41	0·40	0·41	0·35	0·32	0·34	0·33	0·40	0·41
2	0·71	0·71	0·71	0·68	0·68	0·67	0·66	0·65	0·64	0·62	0·62	0·55	0·52	0·56	0·53	0·65
3	0·91	0·90	0·90	0·90	0·87	0·86	0·85	0·85	0·84	0·82	0·79	0·79	0·72	0·69	0·74	0·73
4	1·10	1·08	1·07	1·06	1·06	1·03	1·03	1·02	1·02	1·00	0·97	0·93	0·95	0·89	0·85	0·92
5	1·28	1·25	1·23	1·21	1·20	1·22	1·18	1·18	1·16	1·16	1·13	1·10	1·07	1·10	1·04	1·01
6	1·45	1·42	1·38	1·36	1·34	1·32	1·35	1·31	1·31	1·29	1·27	1·24	1·22	1·20	1·24	1·18
7	1·59	1·57	1·54	1·50	1·47	1·45	1·42	1·46	1·43	1·42	1·39	1·37	1·35	1·34	1·33	1·38
8	1·74	1·70	1·68	1·63	1·60	1·57	1·55	1·51	1·56	1·52	1·51	1·47	1·46	1·46	1·45	1·46
9	1·89	1·83	1·79	1·77	1·72	1·68	1·66	1·63	1·61	1·65	1·60	1·58	1·55	1·55	1·57	1·56
10	2·06	1·98	1·92	1·87	1·85	1·80	1·76	1·74	1·71	1·69	1·72	1·67	1·66	1·64	1·64	1·67
11	2·23	2·14	2·06	1·99	1·94	1·92	1·88	1·83	1·80	1·78	1·75	1·79	1·73	1·73	1·72	1·73
12	2·21	2·31	2·21	2·12	2·05	2·00	1·99	1·94	1·89	1·86	1·83	1·81	1·85	1·80	1·81	1·79
13	2·26	2·28	2·37	2·27	2·18	2·10	2·06	2·04	1·99	1·94	1·91	1·88	1·87	1·91	1·86	1·88
14	2·31	2·31	2·33	2·43	2·32	2·23	2·15	2·11	2·09	2·03	1·98	1·96	1·92	1·92	1·96	1·92
15	2·41	2·36	2·35	2·38	2·47	2·37	2·27	2·19	2·15	2·13	2·07	2·02	2·00	1·97	1·96	2·01
16	2·71	2·46	2·40	2·39	2·41	2·51	2·41	2·31	2·23	2·18	2·16	2·10	2·05	2·03	2·01	2·02
17	2·79	2·75	2·49	2·44	2·42	2·44	2·55	2·44	2·34	2·26	2·21	2·19	2·13	2·09	2·07	2·04
18	2·84	2·82	2·79	2·52	2·46	2·45	2·47	2·57	2·47	2·37	2·28	2·24	2·21	2·16	2·11	2·10
19	2·91	2·87	2·85	2·81	2·54	2·49	2·47	2·49	2·60	2·49	2·39	2·30	2·26	2·24	2·18	2·14
20	3·03	2·93	2·90	2·87	2·83	2·56	2·50	2·49	2·51	2·62	2·51	2·40	2·32	2·28	2·26	2·20

Note: To understand the table, the column for 1930 may be interpreted in the following way. The figure of 0·47 means a total of 0·47 live births per woman for all married women who had been married for one year after the end of the calendar year in which their marriages had taken place, the figure of 0·71 has the same meaning for women who had been married for two years, and so forth. Thus every duration of marriage in the column involves a different marriage cohort—e.g. duration "1" relates to women married in 1929, duration "2" to women married in 1928, etc.

* Duration is calculated in this table as the number of years after the end of the calendar year in which the marriage took place.

TABLE 19

Great Britain: Family Size by Social Class. All Ages at Marriage (not adjusted for Childlessness or standardised for Age at Marriage)
Family Size (Number of Live Births) at Various Durations of Marriage (Years)

Date of first marriage	10 years			15 years			20 years			25 years		
	I	II	I/II	I	II	I/II	I	II	I/II	I	II	I/II
1910	1·92	2·49	·77	2·26	3·10	·73	2·38	3·41	·70	2·41	3·50	·69
11	1·88	2·43	·77	2·21	3·00	·74	2·32	3·28	·71	2·35	3·36	·70
12	1·88	2·40	·78	2·20	2·96	·74	2·31	3 23	·72	2·34	3·32	·70
13	1 88	2·42	·78	2·18	2·96	·74	2·29	3·22	·71	2·32	3·30	·70
14	1·88	2·37	·79	2·16	2·90	·74	2·27	3·15	72	2·29	3·23	·71
15	1·74	2·18	·80	2·00	2·64	·76	2·09	2·84	·74	2·12	2·90	·73
16	1·69	2 17	·78	1·94	2·60	·75	2·03	2·80	·73	2·05	2·86	72
17	1·71	2·20	·78	1·93	2·62	·74	2·01	2·82	·71	2·02	2·88	70
18 . ..	1·69	2 22	·76	1·91	2·64	·72	1·99	2 82	·71	2 00	2 88	·69
19	1·73	2·31	·75	1·94	2·74	·71	2·02	2 94	·69	2·04	3 00	·68
1920	1·68	2·22	·76	1·88	2·61	·72	1·96	2·81	·70	1·98	2·87	·69
21	1·63	2·15	·76	1 83	2·54	·72	1·90	2 72	·70			
22	1·58	2·07	·76	1·78	2·43	·73	1·85	2·61	·71			
23	1·53	2·02	·76	1·72	2·38	·72	1·79	2·55	·70			
24	1·53	1·99	·77	1·72	2·34	·74	1·80	2·52	·71			
25	1·47	1·94	·76	1·65	2·29	·72	1 72	2·47	·70			
26	1·43	1·93	·74	1·61	2·26	·71						
27	1·43	1·86	·77	1·62	2·19	·74						
28	1·41	1·84	·77	1·59	2·17	73						
29	1·41	1·80	·78	1 59	2·15	·74						
1930	1·42	1·85	·77	1·61	2·19	·74						
31	1·41	1·80	·78									
32	1·38	1·79	·77									
33	1·33	1·77	·75									
34	1·38	1·75	·79									
35	1·41	1 75	·81									

APPENDIX 1

SAMPLING ERRORS

In a large sample inquiry such as the Family Census, sampling errors as such are not usually significant in relation to any of the major analyses undertaken. Moreover, it is in any case probable that other types of error—especially errors introduced by bias in an imperfect sample, and errors of statement in questionnaires—outweigh the sampling errors in such an investigation. For the sake of completeness, however, it appeared desirable to include a table giving some idea of the sampling errors involved, and this has been done in Table 20. The table refers only to women whose marriages were still in existence at Census date or, if dissolved, were not terminated until the women were over 45 years of age. This means that, for any cohort of marriage, the number in the sample is constant for any duration of marriage. For each cohort of marriage from 1910 onwards, the table gives the average number of live births per woman by Census date (not adjusted for understatement of childlessness or standardised for age at marriage) and the standard error. It will be seen that the standard errors are very small, and do not interfere with any of the inferences drawn, in the text, from the statistics.

TABLE 20

Great Britain: Family Size (Number of Live Births per Woman) and Standard Errors, for Marriages Still in Existence at Census Date, or not Dissolved until the Women were over 45 Years of Age. (Not adjusted for Childlessness or standardised for Age at Marriage.)

Date of first marriage (1)	Average family size at census date (2)	Standard error (3)
1910	3·097	0·020
1911	2·977	0·019
1912	2·954	0·018
1913	2·941	0·018
1914	2·883	0·017
1915	2·599	0·015
1916	2·555	0·017
1917	2·548	0·018
1918	2·553	0·016
1919	2·665	0·015
1920	2·557	0·013
1921	2·459	0·014
1922	2·357	0·014
1923	2·306	0·013
1924	2·278	0·013
1925	2·202	0·013
1926	2·174	0 013
1927	2·116	0·012
1928	2 073	0·011
1929	2·042	0·011
1930	2·009	0·010
1931	1·957	0·010
1932	1·910	0·009
1933	1·822	0·009
1934	1·760	0·008
1935	1·688	0·008
1936	1·588	0·007
1937	1·496	0·007
1938	1·405	0·006
1939	1·223	0·005
1940	1·049	0·005
1941	0·915	0·005
1942	0·767	0·004
1943	0·655	0·004
1944	0·465	0·004
1945	0·143	0·003

APPENDIX 2

COHORTS OF COMPLETED FERTILITY

In that section of the text which presented some of the main tables derived from the provisional results of the Family Census, an account was given of the trend of average family size (total number of live births per woman) for the cohorts of marriage from 1900–09 to 1925. Attention was drawn to the fact that the later cohorts in the series were not quite complete, for the 1925 cohort had had a marriage duration of only about 20 years by Census date. Since the additional number of births per woman likely to be yielded in moving from say, 20 years duration to 25 years duration, or even from 15 years duration to 20 years duration, is very small, the error involved in the comparison is correspondingly small. By the same reasoning, however, no great error would be involved in extrapolating the fertilities of the later durations and in adding the estimates thereby obtained to the totals for the cohorts of not-quite-complete fertility in order to continue the account to a more recent date.

For this purpose the statistics of average family size by duration (Table 17, adjusted for childlessness but not standardised for age at marriage) have been used to obtain duration-specific live-birth rates. The rates chosen are 5-year rates, obtained by subtracting the averages at 0 years duration from the averages at 5 years, the averages at 5 years from those at 10 years, and so forth. These rates are given in Table 21, the rate at 0 years being the total number of live births per woman at first marriage, as recorded in the Census. The rates have been plotted on semi-logarithmic paper in the accompanying chart (Diagram 1) and freehand curves have been fitted to the results in order to provide a crude basis for extrapolation. The extrapolated rates are given in parentheses in Table 21. The estimates were then added to the known rates to arrive at projected total fertilities at 30 years' duration, and these projected totals are shown in parentheses in Table 22.

TABLE 21

Great Britain: Family Size for Cohorts of Completed Fertility, taking into account Fertility Trends up to Census Date

Duration-Specific Fertility Rates (Average Number of Live Births per Woman in Specified 5-Year Period)

Date of first marriage	Duration (years)						
	0	0–5	5–10	10–15	15–20	20–25	25–30*
1900–09	·05	1·56	·92	·57	·31	·10	·01
1910 ...	·04	1·46	·77	·51	·24	·07	·01
1911 ..	·04	1·42	·76	·47	·22	·06	·01
1912 ...	·04	1·38	·78	·47	·22	·06	·01
1913 ...	·04	1·33	·83	·45	·20	·06	·01
1914 ...	·06	1·26	·87	·43	·20	·06	·01
1915 ...	·04	1·19	·78	·38	·16	·04	·00
1916 ..	·04	1·20	74	·36	·16	·05	
1917 ...	·04	1·25	·70	·34	·15	·04	
1918 ...	·04	1·28	·69	·34	·14	·04	
1919 ...	·04	1·37	·69	·35	·15	·05	
1920 ...	·04	1·32	66	33	·15	·05	
1921 ..	·04	1·29	·62	·31	·14	(·04)	
1922 ...	·04	1·23	·61	·29	·14	(·04)	
1923 ...	·04	1·21	·59	·29	·14	(·04)	
1924 ...	·04	1·19	·58	·29	·14	(·04)	
1925 ...	·04	1·17	·56	·29	·14	(·04)	
1926 ..	·05	1·13	·55	·28	(·14)	(·04)	
1927 ...	·04	1·12	·54	·28	(·14)	(·04)	

DIAGRAM I

Great Britain: 5-year Duration Specific Fertility Rates (Number of live births per woman)

(Corrected for childlessness but not standardised for age at marriage)

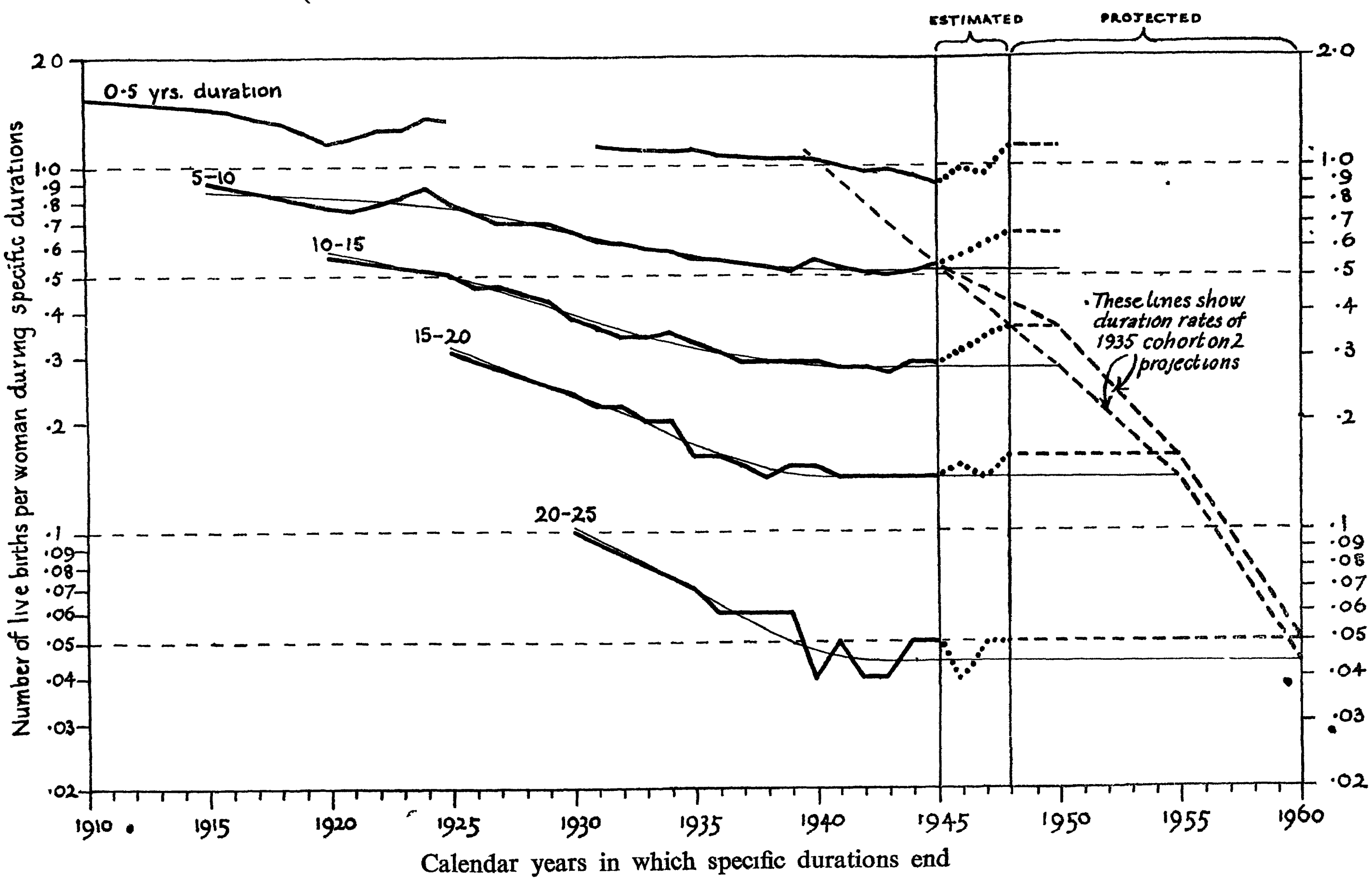


TABLE 21—*continued.*

Date of first marriage	Duration (years)						
	0	0–5	5–10	10–15	15–20	20–25	25–30*
1928 ..	·04	1·11	·53	·27	(·14)	(·04)	
1929 ...	·03	1·10	·51	·29	(·14)	(·04)	
1930 ...	·03	1·11	·55	·29	(·14)	(·04)	
1931 ...	·03	1·08	·53	(·28)	(·14)	(·04)	
1932 ...	·03	1·07	·51	(·28)	(·14)	(·04)	
1933 ...	·04	1·05	·50	(·28)	(·14)	(·04)	
1934 ...	·03	1·06	·51	(·28)	(·14)	(·04)	
1935 ...	·03	1·04	·54	(·28)	(·14)	(·04)	
1936 ...	·03	1·00					
1937 ..	·04	·96					
1938 ...	·03	·99					
1939 ...	·03	·94					
1940 ...	·03	·90					

Figures in ( ) are projections.

* Durations above 25 years are excluded from the later cohorts, both because the fertility rates for those durations were, even for early cohorts, very low, and were following a descending curve.

TABLE 22

Great Britain: Family Size for Cohorts of Completed Fertility, taking into account Fertility Trends up to Census Date

Date of first marriage	Cumulated duration specific rates at various durations of marriage (by xth year of married life)					
	5	10	15	20	25	30
1900–09	1·61	2·53	3·10	3·41	3·51	3·52
1910	1·50	2·27	2·78	3·02	3·09	3·10
1911	1·46	2·22	2·69	2·91	2·97	2·98
1912	1·42	2·20	2·67	2·89	2·95	2·96
1913	1·37	2·20	2·65	2·85	2·91	2·92
1914	1·32	2·19	2·62	2·82	2·88	2·89
1915	1·23	2·01	2·39	2·55	2·59	2·59
1916	1·24	1·98	2·34	2·50	2·55	2·55
1917	1·29	1·99	2·33	2·48	2·52	2·52
1918	1·32	2·01	2·35	2·49	2·53	2·53
1919	1·41	2·10	2·45	2·60	2·65	2·65
1920	1·36	2·02	2·35	2·50	2·55	2·55
1921	1·33	1·95	2·26	2·40	(2·44)	(2·44)
1922	1·27	1·88	2·17	2·31	(2·35)	(2·35)
1923	1·25	1·84	2·13	2·27	(2·31)	(2·31)
1924	1·23	1·81	2·10	2·24	(2·28)	(2·28)
1925	1·21	1·77	2·06	2·20	(2·24)	(2·24)
1926	1·18	1·73	2·01	(2·15)	(2·19)	(2·19)
1927	1·16	1·70	1·98	(2·12)	(2·16)	(2·16)
1928	1·15	1·68	1·95	(2·09)	(2·13)	(2·13)
1929	1·13	1·64	1·93	(2·07)	(2·11)	(2·11)
1930	1·14	1·69	1·98	(2·12)	(2·16)	(2·16)
1931	1·11	1·64	(1·92)	(2·06)	(2·10)	(2·10)
1932	1·10	1·61	(1·89)	(2·03)	(2·07)	(2·07)
1933	1·09	1·59	(1·87)	(2·01)	(2·05)	(2·05)
1934	1·09	1·60	(1·88)	(2·02)	(2·06)	(2·06)
1935	1·07	1·61	(1·89)	(2·03)	(2·07)	(2·07)
1936	1·03					
1937	1·00					
1938	1·02					
1939	0·97					
1940	0·93					

Figures in ( ) are projections.

It is, however, possible to obtain a number of more recent duration-specific rates by estimation rather than by hypothetical projection. Thus, in order to ascertain, if only approximately, the fertility position at the end of 1948, after three years of high birth rates, as compared with the position at the end of 1945, as shown by the Family Census, Mr. W. A. B. Hopkin used the vital statistics for those three years and "spliced" them to the results given by the Census. The broad results of this "splicing" are discussed in the report of the Royal Commission, and the method used is outlined in Appendix 3 to the present study. By using this method it has been possible to add data for three more cohorts of marriage and for durations up to 25 years. These data have also been plotted on the semi-logarithmic chart referred to earlier, and it will be seen that the duration rates have risen, especially for durations above 5 years, though it appears also that the rise may have ceased for all durations up to 20 years. Whether that is true will become visible during the next few years. At the moment, however, the relevance of the approximate rates for 1946–1948 is that the graph may be extended with their help and that a second basis of projecting future rates may be adopted, namely, by assuming the continuance of the rates at the level shown at the end of 1948. This, too, has been done in the chart, and the results are given in Tables 23 and 24.

TABLE 23

Great Britain: Family Size for Cohorts of Completed Fertility, taking into account Fertility Trends up to 1948

Duration—Specific Fertility Rates (Average Number of Live Births per Woman in Specified 5-Year Period)

Date of first marriage	Duration (years)					
	0	0–5	5–10	10–15	15–20	20–25
1921	·04	1·29	·62	·31	·14	[·04]
1922	·04	1·23	·61	·29	·14	[·05]
1923	·04	1·21	·59	·29	·14	[·05]
1924	·04	1·19	·58	·29	·14	(·05)
1925	·04	1·17	·56	·29	·14	(·05)
1926	·05	1·13	·55	·28	[·15]	(·05)
1927	·04	1·12	·54	·28	[·14]	(·05)
1928	·04	1·11	·53	·27	[·16]	(·05)
1929	·03	1·10	·51	·29	(·16)	(·05)
1930	·03	1·11	·55	·29	(·16)	(·05)
1931	·03	1·08	·53	[·31]	(·16)	(·05)
1932	·03	1·07	·51	[·34]	(·16)	(·05)
1933	·04	1·05	·50	[·36]	(·16)	(·05)
1934	·03	1·06	·51	(·36)	(·16)	(·05)
1935	·03	1·04	·54	(·36)	(·16)	(·05)
1936	·03	1·00	[·57]			
1937	·04	0·96	[·62]			
1938	·03	0·99	[·65]			
1939	·03	0·94				
1940	·03	0·90				

Figures in [ ] are estimates.
Figures in ( ) are projections.

TABLE 24

Great Britain: Family Size for Cohorts of Completed Fertility, taking into account Fertility Trends up to 1948

Date of first marriage	Cumulated duration specific rates at various durations of marriage (by xth year of married life)				
	5	10	15	20	25
1921	1·33	1·95	2·26	2·40	[2·44]
1922	1·27	1·88	2·17	2·31	[2·36]
1923	1·25	1·84	2·13	2·27	[2·32]
1924	1·23	1·81	2·10	2·24	(2·29)
1925	1·21	1·77	2 06	2·20	(2·25)
1926	1·18	1·73	2·01	[2·16]	(2·21)
1927	1·16	1·70	1·98	[2·12]	(2·17)
1928	1·15	1·68	1 95	[2·11]	(2·16)
1929	1·13	1·64	1·93	(2·09)	(2·14)
1930	1·14	1·69	1·98	(2·14)	(2·19)
1931	1·11	1·64	[1·95]	(2·11)	(2·16)
1932	1·10	1·61	[1·95]	(2·11)	(2·16)
1933	1·09	1·59	[1·95]	(2·11)	(2·16)
1934	1·09	1·60	(1·96)	(2·12)	(2·17)
1935	1·07	1·61	(1·97)	(2·13)	(2·18)
1936	1·03	[1·60]			
1937	1·00	[1·62]			
1938	1·02	[1·67]			
1939	0·97				
1940	0·93				

Figures in [ ] are estimates.
Figures in ( ) are projections.

No real validity is attributed to either set of projected rates. Nevertheless there is little reason to doubt, taking into account the trend and size of the known rates, that the margin of possible error in the projected totals cannot be substantial when the projections refer only to durations above 15 years. Thus the margin of error in the projected totals for the cohorts of 1916 to 1930 must be small. Indeed it is doubtful if the error can be very large even for projections beyond 10 years duration, for in present circumstances the fertility contributed during the period between the 10th and 15th years of married life does not appear to amount to more than about one-sixth of that contributed between marriage and the 10th year of duration. It is thus possible to obtain a reasonable indication of the total fertility of the various cohorts of marriage up to 1935. No attempt has been made to go beyond the 1935 cohort, both because of the provisional nature of the Family Census material and because of the uncertainty of the statistics relating to post-war trends. For the cohorts up to 1935, the main results are summarised in Table 25.

It will be seen that the two sets of projected results do not differ by more than about 1 per cent. until the 1928 cohort is reached. Beyond that point the difference increases, amounting to about 6 per cent. for the 1935 cohort, and the difference would be still greater—amounting to about 12 per cent.—if the projections were taken up to the cohort of 1940. Reconsideration of the graph suggests, however, that the most probable figures lie between the upper and lower estimates. In fact, the figures suggest that, superimposed on the general parallelism of the duration-specific rates, is another tendency, namely the tendency for later duration rates to move in contrary motion to earlier rates when those rates strike away from the general trend. Thus the 0–5 year rates move more sharply downwards during World War 1, and are counterbalanced

TABLE 25

Great Britain: Total Numbers of Live Births per Woman for Cohorts of Completed Fertility

Date of first marriage (1)	Not involving projections except beyond 25th year of marriage duration (2)	Involving projections for earlier durations, projections being based on Family Census results (2)	Involving projections for earlier durations, projections being based on position at end of 1948 (4)
1900–09	3·52	—	—
1910	3·10	—	—
1911	2 98	—	—
1912	2·96	—	—
1913	2·92	—	—
1914	2·89	—	—
1915	2·59	—	—
1916	2·55	—	—
1917	2 52	—	—
1918	2·53	—	—
1919	2·65	—	—
1920	2 55	—	—
1921	—	2·44	2·44*
1922	—	2·35	2·36*
1923	—	2·31	2·32*
1924	—	2·28	2·29*
1925	—	2·24	2·25
1926	—	2·19	2·21
1927	—	2·16	2·17
1928	—	2·13	2 16
1929	—	2·11	2·14
1930	—	2·16	2·19
1931	—	2·10	2·16
1932	—	2·07	2 16
1933	—	2·05	2·16
1934	—	2·06	2·17
1935	—	2·07	2·18

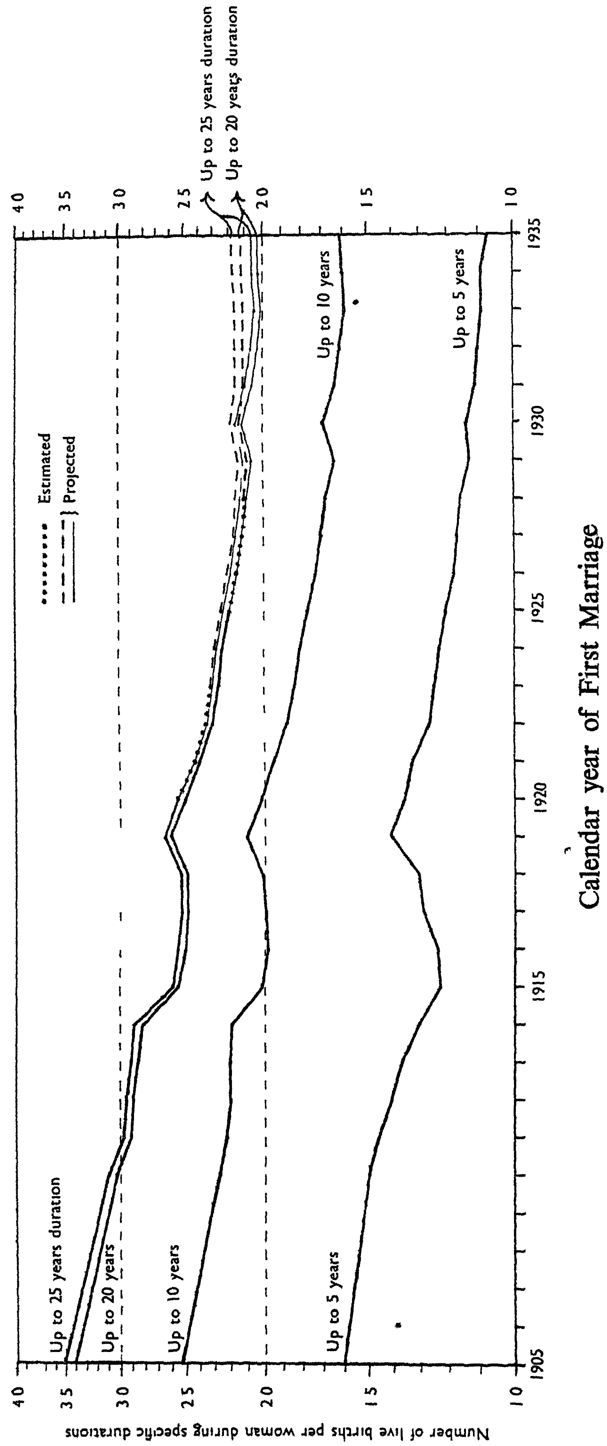
* These totals involve estimates, rather than projections, of the fertility beyond the 25th year of marriage since they make use of the vital statistics for 1946–48.

by a subsequent upward movement of the 5–10 year rates of the cohorts concerned. When the 0–5 year rates rise after 1920 there is a counterbalancing downward movement of the 5–10 year rates for those cohorts in 1924–28. Similarly, in the more recent period, it may be possible to explain at least part of the rise after 1945 of the rates for durations above 10 years in terms of a counterbalance to the fall between 1940–45 in the rates at 0–5 years. The difficulty is to disentangle such tendencies from cyclical fluctuations and also from another apparent tendency for the total fertility of a cohort to be affected by the circumstances of the early years of married life when those circumstances are especially abnormal. In considering the latter tendency, however, it is important to remember that the one obvious example, the low total fertility of marriages taking place during World War 1, would also have been affected by the separation of husbands and wives during the war itself. This effect would also apply to marriages taking place in 1940–45, though not to so marked a degree

But leaving aside these conflicting factors, a not unreasonable hypothesis would be that total family size is the objective which, though perhaps unconsciously, conditions the behaviour of the duration rates and that, in consequence, the trend of total family size is both clearer and more meaningful than the trend of any set of duration or other specific fertility rates. This is suggested by the curves of cumulative fertility plotted in Diagram 2. In that case the rise during 1945–48 in the rates for durations above 10 years might

DIAGRAM II

Great Britain: Cumulative Duration Specific Fertility Rates



then be followed by a fall in the rates for those durations as the cohorts experiencing a rise in the 0–5 years duration rates in 1945–48 pass into the later duration group. The implication of this compensating fluctuation in the duration rates may be seen with reference to the projections of completed fertility given in Table 25. For the more recent cohorts, the projected values given in Column 3, are definitely too low, since they do not take into account at all the rise in the duration-specific fertility rates after 1945. In fact they are included here only to show the results of extrapolating from the position found as at the date of the Family Census. On the other hand it is very likely that the projected values given in Column 4 are somewhat too high, for they are based on a continuance of the higher duration rates of 1948 and do not allow for any compensating fluctuation of the kind mentioned above.

A closer view of the probable trend of completed fertility may perhaps be obtained by approaching the problem of projection in a somewhat different way. Thus it is possible to trace the behaviour of the 1927 cohort of marriages, almost the last to pass through the first 10 years of married life before the outbreak of World War II, and the last for which the position as of the end of 20 years of married life is known. It is also possible to build up hypothetical cohorts of marriage subject to the duration-specific fertility rates observed in a given period—showing, for example, what fertility would result if the duration-specific rates obtaining in 1935–38 (the last pre-war years) or in 1939–47 (the whole of the war and post-war period) were to persist throughout the married life of a group of women. These two latter estimates are, of course, based on assumptions which previous analysis has shown to be untenable—namely, that the separate duration-specific rates are independent variables. Nevertheless, the estimates may be of value in indicating how much divergence would result from applying such methods to the specific circumstances of the recent past, and particularly in showing whether the use of hypothetical cohorts would, in these circumstances, lead to palpably fantastic conclusions. The three sets of data are given in Table 26, and it may be seen that, in fact, in spite of some divergence between the three sets of values at the shorter durations of marriage, the ultimate values range only between 2·097 and 2·180. The real range is somewhat narrower, for it has not been possible to include in the estimates in Column (*c*) the data for short durations for those most recent years in which early duration rates had risen. The similarity of the three sets of values is, of course, evidence of the stabilisation of fertility in recent years.

The three sets of values in Table 26 may be used to complete the data for the marriages of incomplete fertility. The method and results are shown in Table 27. For the marriage cohort of 1931, for example, the data up to 1948 yield the family size by the 17th year of duration. Estimates of the residual fertility of the period between the 17th and 25th years of married life may be obtained from columns (*a*), (*b*) or (*c*) of Table 26. Thus for Column (*a*), the additional fertility is (2·180–2·049) or 0·131. For Column (*c*), the additional fertility is (2·097–1·976) or 0·121. These quantities can then be added to the known size of family at the 17th year of marriage, namely 2·034, giving results of 2·165 and 2·155 respectively. Estimates arrived at in this way for the individual marriage cohorts from 1924 to 1935 are given in columns 8–10 of Table 27. The three sets of results naturally tend to show a somewhat greater divergence for the most recent cohorts of marriage. But for no cohort is the divergence at all marked. It will also be noticed that, for the most recent cohorts, (1933–35), all three estimates are below those of Table 25, Column (4). The general picture yielded by Table 27 is again one of stability for the recent cohorts (this is further borne out if the estimates are taken forward to include the cohorts of 1936–38), with a gentle fluctuation but no clear upward or downward trend, the gross fertility of the more recent cohorts perhaps amounting to about 2·15–2·17 live births per marriage.

TABLE 26

Great Britain: Average Family Size

Duration (years)	Family size resulting from duration-specific fertility rates of: (a) 1927 cohort	(b) 1935–38	(c) 1939–47
Before marriage	·040	·034	·031*
After marriage: 0–1 years	·336	·289	·238*
1–2 ,, ...	·610	·546	·480*
2–3 ,, ...	·819	745	·668*
3–4 ,, ...	1·000	·920	·841
4–5 ,, ...	1·161	1·075	1·000
5–6 ,, ...	1·296	1·213	1·148
6–7 ,, ...	1·415	1·333	1·280
7–8 ,, ...	1·522	1·435	1·397
8–9 ,, ...	1·617	1·528	1·499
9–10 ,, ...	1·700	1·611	1·588
10–11 ,, ...	1·772	1·686	1·669
11–12 ,, ...	1·836	1·750	1·733
12–13 ,, ...	1·891	1·808	1·795
13–14 ,, ...	1·937	1·859	1·849
14–15 ,, ...	1·977	1 904	1·897
15–16 ,, ...	2·014	1 944	1·938
16–17 ,, ...	2·049	1·978	1·976
17–18 ,, ...	2·082	2·009	2·003
18–19 ,, ...	2·115	2·034	2·030
19–20 ,, ...	2·129	2·053	2·050
20–21 ,, ...	2·157	2·069	2·066
21–22 ,, ...	(2·158)	2·082	2·078
22–23 ,, ...	(2·172)	2·092	2 087
23–24 ,, ...	(2·180)	2·100	2·093
24–25 ,, ...	(2·180)	2·105	2·097

* Complete data not available.
( ) Including estimates for values beyond 20 years duration.

TABLE 27

Great Britain: Projected Average Family Size after 25 years Duration of Marriage

Year of Marriage (1)	Last Duration in 1948 (2)	Average Family Size (3)	25 years minus col. (2) (4)	Rates derived from assumptions: (a) (5)	(b) (6)	(c) (7)	Estimated average family size after 25 years duration on assumptions: (a) (8)	(b) (9)	(c) (10)
1924 ...	24	2·298	1	—	·005	·004	2·298	2·303	2·302
1925 ...	23	2·236	2	·008	·013	·010	2·244	2·249	2·246
1926 ...	22	2·185	3	·022	·023	·019	2·207	2·208	2·204
1927 ..	21	2·157	4	·023	·036	·031	2·180	2·193	2·188
1928 ...	20	2·109	5	·051	·052	·047	2·160	2·161	2·156
1929 ...	19	2·120	6	·065	·071	·067	2·185	2·191	2·187
1930 ...	18	2·112	7	·098	·096	·094	2·210	2·208	2·206
1931 ...	17	2·034	8	·131	·127	·121	2·165	2·161	2·155
1932 ...	16	2·009	9	·166	·161	·159	2·175	2·170	2·168
1933 ...	15	1·945	10	·203	·201	·200	2·148	2·146	2·145
1934 ...	14	1·901	11	·243	·246	·248	2·144	2·147	2·149
1935 ...	13	1·866	12	·289	·297	·302	2·155	2·163	2·168

APPENDIX 3

THE ESTIMATION OF AVERAGE FAMILY SIZE OF VARIOUS COHORTS AT THE END OF 1948

By W. A. B. HOPKIN

For the purposes of the Royal Commission on Population it was desired to evaluate the trend of " average family size " over the war and post-war period as a whole. The object was to answer such questions as the following: how did the average number of children born to a group of couples who in 1948 completed 10 years of married life compare with that born to a group reaching the same stage in 1938? In order to do this, it was necessary to estimate, for 1946, 1947 and 1948, figures of the same kind as are shown in Table 18 above. Since the Census was taken in early 1946, to carry the figures on in this way required estimates of the rates of addition to the families of the various cohorts in 1946, 1947 and 1948.

At the time when the calculation was made there were some gaps in the information from which these estimates could be derived, but enough was available to make it seem likely that a calculation trustworthy in its main conclusions could be made. The starting point of the calculation was provided by the Family Census in the figures for the total number of live births per married woman in each cohort by year of marriage at the end of 1945. Family Census data also provided estimates of the gross fertility rates at various (calendar) durations in Great Britain, 1935–38, which entered as one of the bases of calculation of similar gross fertility rates for 1946, 1947 and 1948.

No information about the distribution of births in Great Britain in 1946–48 by exact date of marriage was available. The Registrar General for England and Wales had, however, provided the Royal Commission with a tabulation of a sample of the 1946 births in that country which provided, *inter alia*, an analysis by calendar year of marriage of the mother. The proportions shown in this sample were assumed to apply among the births of the year as a whole, and the number so attributed to each cohort of marriages was divided by the number of first marriages of women under 45 in the relevant calendar year. The resulting rates may be called net fertility rates, since their calculation makes no reduction in the denominator for marriages dissolved by death or divorce (the gross fertility rates for 1935–38 mentioned above, in contrast, were calculated from a group of women whose marriages had all lasted without interruption to and through the period in which the relevant births took place).

By this means a series of net fertility rates for cohorts of married women was calculated for England and Wales, 1946. A similar set of rates was also calculated for 1947, but for this purpose the information available was less satisfactory, consisting of a tabulation of the births of the year by *exact* duration (the usual basis of the tabulations given by the Registrar General in his *Statistical Review*). By a process of interpolation, starting from the calendar net fertility rates of 1946, and using the tabulation of 1947 births by exact duration, calendar net fertility rates were estimated for England and Wales, 1947.

A series of net fertility rates for England and Wales, 1939, was available, having been calculated by Mr. J. Hajnal for another purpose (see his report on **Births, Marriages and Reproductivity, England and Wales**, 1938–47, Note IV). The 1939 rate for each duration was divided successively into the

corresponding 1946 and 1947 rates. This gave two series of multipliers describing the change in fertility at each duration in England and Wales from 1939 to (*a*) 1946 and (*b*) 1947. The next step was to transform these into another two series of multipliers appropriate to the change in Great Britain from 1935–38 to (*a*) 1946 and (*b*) 1947. It was assumed that for each of the 2 periods of change the Great Britain multipliers at various durations would bear a constant relation to the England and Wales multipliers. Modifying factors were therefore calculated by comparing the increase in the net fertility of marriage(1) from 1935–38 to 1946 (or 1947) in Great Britain with the increase from 1939 to 1946 (or 1947) in England and Wales, and these were applied to the multipliers described above. The modified multipliers were then applied to the gross fertility rates for Great Britain in 1935–38 to produce estimated gross fertility rates for 1946 and 1947. By adding successively the rates for the relevant durations in 1946 and 1947, the estimated total of live births to each cohort of married couples could be brought forward first to the end of 1946 and then to the end of 1947.

For 1948 only the total number of legitimate births was known at the time of calculation: no duration data were available. It was therefore assumed that each duration fertility rate of 1948 bore to the corresponding 1947 rate the same proportion, being the ratio of the net fertility of marriage 1948 to that of 1947. This assumption is certainly questionable; fortunately, however, the 1948 rates are a much less important element in the final result than the rates of 1946 and 1947, which are certainly more reliable in detail.

The gross fertility rates estimated for Great Britain in the various periods by the methods described, and the resulting figures for total numbers of births per married woman at various dates, are given in Table 28. The relation between the two sets of figures may be illustrated with an example. The total number of children born per marriage up to the end of 1945 to the couples married in 1944 is given by the Family Census as ·4126 (column (7)). The estimated rate of addition to these families in 1946, when they were passing through duration 2, is ·2121 (column (3)). The average size of family of the cohort at the end of 1946 is therefore ·4126 plus ·2121, i.e., ·6247 (column (8)). In 1947 the cohort passes through duration 3 and has a fertility rate of ·2117 (column (4)), so that its average size of family at the end of 1947 is ·6247 plus ·2117, i.e., ·8364 (column (9)). In 1948 the fertility rate added is that of duration 4 (·1734) so that the average size of family at the end of 1948 is 1·0098 (column (10)). The fertility of other cohorts is built up in the same way.

(1) Calculated by the method described by Mr. Hajnal in Note IV to the report already referred to.

TABLE 28

Estimated Gross Fertility Rates at Durations, Great Britain, 1946, 1947 and 1948, and estimated Total Number of Live Births per Married Woman of Various Cohorts at end 1945, 1946, 1947 and 1948

Duration of marriage (calendar)	Estimated gross fertility rates, Great Britain				Year of marriage of cohort	Estimated total number of live births per married woman at the end of—			
	1935–38	1946	1947	1948		1945	1946	1947	1948
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2	·2276	·2121	·2563	·2204	1944	·4126	·6247	·8364	1·0098
3	·1869	·1851	·2117	·1821	1943	·6468	·8319	1·0335	1·2014
4	·1652	·1838	·2016	·1734	1942	·7250	·9088	1·1040	1·2580
5	·1468	·1807	·1952	·1679	1941	·9224	1·1031	1·2821	1 4205
6	·1293	·1720	·1790	·1540	1940	1 0144	1·1864	1·3473	1·4613
7	·1114	·1539	·1609	1384	1939	1·1842	1·3381	1·4706	1·5637
8	·0977	·1316	·1325	·1140	1938	1·3766	1·5082	1·6165	1·7023
9	·0881	·1145	·1083	·0931	1937	1·4586	1·5731	1·6728	1·7467
10	·0792	·1040	·0997	·0858	1936	1·5628	1·6668	1·7527	1·8162
11	·0696	·0896	·0859	·0739	1935	1·6675	1·7571	1·8309	1·8856
12	·0610	·0769	·0738	·0635	1934	1·7305	1·8074	1·8710	1·9211
13 ..	·0547	·0663	·0636	·0547	1933	1·7910	1·8573	1·9155	1·9576
14	·0482	·0606	·0582	·0501	1932	1·8773	1·9379	1·9868	2 0232
15	·0426	·0506	·0489	·0421	1931	1·9193	1·9699	2 0122	2·0420
16	·0371	·0437	·0423	·0364	1930	2·0145	2·0582	2·0929	2·1193
17	·0324	·0359	0347	·0298	1929	2·0219	2·0578	2·0885	2·1080
18	·0277	·0317	·0307	·0264	1928	2·0438	2·0755	2·0982	2·1163
19	·0221	·0234	·0227	·0195	1927	2·0987	2·1221	2·1431	2·1559
20	·0178	·0192	·0210	·0181	1926	2·1411	2·1603	2·1752	2·1842
21	·0145	·0137	·0149	·0128	1925	2·2040	2·2177	2·2282	2·2359
22	·0112	·0096	·0105	·0090	1924	2 2746	2·2842	2·2932	2 2984
23	·0086	·0082	·0090	·0077					
24	·0064	·0055	·0060	·0052					
25	·0043	·0045	·0047	·0040					
26	·0021	·0020	·0021	·0018					
27	·0008	·0007	·0007	·0006					

APPENDIX 4

ROYAL COMMISSION ON POPULATION

FAMILY CENSUS — Strictly Confidential

If you care to fill up this form yourself please do so and give it completed to the Royal Commission Enumerator who will call to see you. If you prefer it however the Enumerator will be glad to fill up the form for you or help you with any difficulties you may have

FOR OFFICIAL USE ONLY

FO.______

SN.______

YOURSELF — *Please write clearly and in full*

1 Are you now MARRIED or WIDOWED— or was your last marriage ended by DIVORCE? *Please state which*

2 When were you born? (Month / Year)

3 For those who have been MARRIED ONCE ONLY: (Month / Year)
(a) When were you married?
(b) If your marriage has ended—when did it end? *(By death of your husband or divorce—NOT separation)*

4 For those who have been MARRIED MORE THAN ONCE (Month / Year)
(a) When were you FIRST MARRIED?
(b) When did your FIRST MARRIAGE END?

Official use: 1 — M 1, M 2, MM 3, MM 4, W 5, W 6

YOUR CHILDREN (Month / Year)

5 (a) NUMBER OF CHILDREN BORN ALIVE.
Beginning with your FIRST BORN child—enter in order of birth, the date of birth of EVERY LIVE BORN CHILD you have had—*whether or not the child is still living*
Do NOT include still-births or miscarriages.
In the case of twins or triplets use a separate line for every child born alive
Step-children or adopted children should NOT be counted

1st child, 2nd, 3rd, 4th ,, 5th ,, 6th ,, 7th ,, 8th ,, 9th, 10th ,,

(b) NO CHILDREN
If you have NOT borne a living child, write NIL in this box

NOTE: For those who have had more than 10 children there are more spaces on the back

Official use: 2 — 1 P, 2 E, 3 OA, 4 S, 5 WE, 6 WM, 7 F, 8 AW, 9 L, X AF

3 LC

4 TC

6 Of your children ALIVE today, how many have NOT yet reached their SIXTEENTH birthday?
(Only children BORNE BY YOU and under 16—even if they are living away from you)

INTERVIEW DATE

YOUR HUSBAND — *If possible, discuss this section with your Husband*

7 (a) What is your HUSBAND'S OCCUPATION?
(If he is retired out of work, or dead—state his former occupation)
(If he is temporarily in the Services—state former occupation. If no former occupation—put 'Armed Forces')
(If he is a regular Sailor, Soldier or Airman—state which and his rank)
(If you have been married more than once—the answer should refer to your FIRST husband)

NOTE: Please describe the KIND of work your husband does in as much detail as possible. For example: If your husband is an Engineer, it will help us if you can say EXACTLY which kind he is.

(b) IS YOUR HUSBAND—
1 An employer of 10 or more people?
or
2 Working for himself or employing LESS than 10 people?
or
3 Employed and earning a monthly salary?
or
4 Employed and earning a weekly or other wage?

PLEASE PUT A RING ROUND THE NUMBER WHICH APPLIES

(c) EMPLOYER'S BUSINESS—
(If your husband is NOT himself an employer or working for himself)

5 (a) NUMBER OF CHILDREN BORN ALIVE—*continued*

	Month	Year
11th child		
12th ,,		
13th ,,		
14th ,,		
15th ,		
16th ,,		
17th ,,		
18th ,,		
19th ,,		
20th ,,		
21st ,,		
22nd ,		

NAME	ADDRESS

The Analysis of Birth Statistics, 1939-1943

MEMORANDUM BY J. HAJNAL

Note by the Committee This paper was written in the early months of 1946 and is here reprinted in its original form. Since the time at which it was written much additional information relevant to the problems treated has become available, but it has not been possible to arrange for the text to be revised and brought up to date. In deciding to publish the report in its original condition we have been mainly actuated by the consideration that it may be of interest to students of demography as an exercise in the detailed analysis of fertility statistics. At the request of the author, however, we make it clear that the report as it stands does not necessarily represent his present views either in respect of methods of analysis or in the conclusions about the history of fertility in the period covered.

1. The question mainly discussed in this memorandum is whether the rise in the fertility rates of married women in 1941–43 can be accounted for entirely by pointing to purely ephemeral factors connected with war-time circumstances and having no connection with the long-term trend in the size of family. In particular the evidence for the hypothesis that the rise in fertility rates in 1942 and 1943 was due to births postponed earlier in the war is examined in detail.

2. The principal materials for analysing the significance of recent fertility statistics are the tabulation of maternities by age of mother, duration of marriage and number of previous children on the one hand, and the populations of married women according to age and duration of marriage estimated by the General Register Office on the other. It should be noted that the necessary materials for making the fullest possible use of the registration data are not available.

3. To assess thoroughly the significance of the fact that certain numbers of births occurred in a certain year it would be necessary to know how many births the women concerned had already had. This information is not in general available. But it is crucial for the analysis of fertility, if it is supposed (as is done by entertaining the "postponement" hypothesis) that married couples are influenced in their decision to have children in any one year by the number of children they have already had.

4. In the light of this consideration, the fertility rates used in the analysis should take account of the number of children married women have had. Rates of *n*th births as related to the number of women who have had *n–1* births, the number of births necessary to have an *n*th child, would seem to be required. To assess whether a rise or fall in the number of fourth children represents an increase or decrease in the proportion of women with three children who go on to having a fourth child, it is necessary to know how many women have had three children. If it were possible to determine definitely that in 1943 and 1944 the couples who had had three children were going on to the fourth at a lower rate than in the previous years it could be said with some confidence that family size was still decreasing. The converse would not necessarily follow, as the rate at which women with three children were going on to have a fourth might be increased simply because of a past postponement of fourth children.

5. Rates of this sort—*n*th births per woman with *n–1* previous children—will be referred to repeatedly. They have been termed "true" birth order rates, so as to distinguish them from other ways of making use of the statistics of births by order. By various, more or less reliable, means it has been possible to obtain some "true" birth-order rates for a few special sections of the population of married women. These rates are given in Section VI.

6. Of the other difficulties in the way of a satisfactory analysis of recent birth statistics, the most important is the absence of knowledge about the

effects of the separation of married couples in war-time. It has obviously been necessary to try to take account of the magnitude of this factor. The following procedure was adopted as the best available. The average numbers of men in the Armed Forces abroad in the periods March 1941 to March 1942 and March 1942 to March 1943 were computed on the basis of data supplied by the Service Departments. These averages were multiplied to obtain the number of married men, by "proportions married" also supplied by the Service Departments.(1) Adjustments had further to be made to exclude men from Scotland and to make allowance for the fact that some members of the Armed Forces were overseas even in peace-time. By this process a very approximate figure was obtained for the numbers of husbands separated from their wives owing to special circumstances due to the war throughout the periods relevant to the conceptions of 1942 and 1943 respectively. If it be assumed that all the wives of these husbands were under 40—a conservative assumption as many of the men are over 45—the proportion of married women who were "sterilized" by the absence of their husbands in the period relevant to the maternities of 1942 was 4·8 per cent. For 1943 the figure was 9·6 per cent.

7. Owing to the slender basis on which these estimates rest, the figures must be regarded as giving only the order of magnitude. Moreover, it is difficult to apply them as the younger and more fertile women were most heavily affected. It is possible to make a very rough guess at the age distribution(2) of the wives whose husbands were abroad. The age distribution obtained must be regarded as no more than an indication of what may reasonably be supposed to have taken place. By the use of this age distribution it was estimated that if the wives whose husbands were abroad had had children at the same rate as other married women, there would have been 663,000 legitimate maternities in 1942 and 725,000 in 1943. In fact there were only 628,000 legitimate maternities in 1942 and 652,000 in 1943. Thus the absence of husbands overseas resulted according to this computation in the "loss" of 5·3 per cent. of the maternities which could otherwise have occurred in 1942. For 1943, 10·1 per cent. of maternities were "lost" owing to this cause.

8. There are several other weaknesses in the analysis presented here. Thus in 1939 and 1940 only the maternities registered were tabulated by age of mother, birth-order and marriage duration. In 1940 the discrepancy between the number of maternities occurring and the number registered was considerable. It has been assumed that the maternities occurring were distributed between the different marriage durations, birth-orders, etc., in the same proportion as were the registrations. This assumption cannot be correct.

9. There are of course the usual difficulties in regard to the treatment of "not stateds" or the accuracy of some of the registration data; for example, the figures for maternities occurring in the first nine months of marriage may be understated, or mistakes may occur in the statements of the numbers of previous children (e.g., by the omission of stillbirths).(3)

10. It has been thought better not to burden the main text with accounts of detailed adjustments necessary in the computation of the tables. All points essential to the understanding of the tables have been given in the text. Fuller information about the details of computation has been added in separate notes at the end.

(1) The proportion married is lower among members of the forces, and particularly among members of the forces abroad, than in the population at large.

(2) See Note (*a*).

(3) Cf. *The Registrar General's Statistical Review, 1938, Tables, Part II, Civil*, p. 132.

11. Some of the calculations given (particularly those in Sections V and VI) are rather conjectural. The figures have sometimes been given to greater accuracy than the reliability of the material may warrant. It has been thought better to err on this side than to conceal differences of interest by rounding. It is usually difficult to determine just how many decimal places can be trusted. The consistency of the results must be one guarantee of their accuracy.

I. Special Features of the Years under Consideration

12. It is convenient at the outset to illustrate some important features in the fertility experience of the years under consideration which have conditioned the analysis. The first is that the sharp increase in the frequency of marriage at young ages in the first years of the war and—probably to a lesser extent—the age distribution of marriages since 1941 has considerably affected the significance of fertility rates by age. The sudden fall after the outbreak of war in the proportion of marriages in which the bride was pregnant at marriage illustrates the fact that marriages were anticipated. The rates in the following table are based on the maternities(1) registered in each year. They have been related to the sum of the marriages of appropriate age in the first half of the current year and the last half of the previous year. It will be appreciated that owing to the sudden fluctuations in marriages and the ages at marriage, the rates for 1940–42 are somewhat uncertain.

TABLE I(2)

Rates of First Maternities in the first 9 Months of Marriage per 1,000 Relevant Marriages

Age at maternity	Year of maternity				
	1939	1940	1941	1942	1943
Under 20	505	289	250	233	243
20–24	195	120	105	106	114
25–29	96	66	67	74	74
30–34	88	63	69	75	83
35–39	70	57	63	63	69
40–44	33	24	30	27	39

The figures for 1939 relate to marriages contracted before the outbreak of war.

13. The figures for 1940, relating mainly to marriages contracted after the outbreak of war, show a sharp fall over the pre-war figures, particularly at the younger ages. Many of the marriages of young women at the beginning of the war must have been contracted by persons who would not normally have married so young. It may be noticed that the rise after 1941 in the proportion of marriages in which the bride was pregnant at marriage is smaller at the younger than at the older ages(3). This phenomenon suggests that "anticipated" marriages continued to occur even after the first rush of marriages was over.

(1) All tables in this paper are in terms of maternities and not live births (except in Section IV where totals of live and still births are sometimes used). The word "births" has however, been employed in the text for convenience, where it does not affect the argument which category is used.

(2) See Note (b).

(3) It should be mentioned that the occurrence of "anticipated" marriages cannot be the full explanation of the fact that the rates in Table I rose less after 1941 at the younger ages than at the older ages. The number of ante-nuptial conceptions declined during the war in relation to the number of unmarried women as well as in relation to the number of marriages. It may be that circumstances connected with the war had resulted in a general reduction in the extent of irregular sexual relations of the kind in which a conception normally leads to marriage.

14. The pattern of marriage rates in 1942–43 also suggests that "anticipated" marriages continued to take place. The probability that a girl marries before age 20 was 0·18 according to the gross nuptiality of 1942 and 0·16 according to that of 1943. The corresponding figure for 1938 was 0·11. On the other hand the probability of marrying at ages above 25 had fallen below pre-war level by 1943.

15. The constitution of the population of married women by age groups must have been considerably disturbed by the war marriages. It would not be correct to conclude, because the fertility of the women marrying at 20 in 1940 was lower than the fertility of women marrying at the same age in 1938, that family size had fallen. The fertility of women marrying at early ages during the war years would be expected to be different from that of the women who "normally" married at early ages. It has not been thought advisable, therefore, to compare fertility rates by age during the war years with those before the war. On the whole, rates specific by duration only have been preferred. Another advantage of this procedure was that it greatly simplified an analysis of very considerable complexity.

16. A second feature of importance for the consideration of the fertility experience of 1939–43 is the distribution of births by order. This is shown in Table II.

TABLE II(1)

Legitimate Maternities According to Previous Children (whether Surviving, Dead or Stillborn) by Present Husband(2), 1939–43

(thousands)

Number of previous children	1939	1940	1941	1942	1943
0 ...	257 3	252 4	251·2	288·4	295·7
1 ...	157 3	145 0	132·5	158·9	176·6
2 ...	78·2	75 0	73·2	78·2	80·2
3 ...	41·5	40·5	40·0	40·7	40 1
4 ...	25·0	23 8	23·0	23·2	22·6
5 ...	15·8	15 1	14·7	13·9	13 6
6 ...	10·5	9·7	9·3	9·3	8·7
7 ...	7·1	6·3	6 3	5·9	5·7
8 ...	4·7	4 3	4 0	3·8	3·5
9 ...	3·0	2 8	2 7	2·5	2·4
10 or more ...	4·2	3·9	3 8	3·5	3·3
TOTAL ...	604·7	579·0	560·6	628·2	652·4

17. To appreciate the exact significance of the totals of births by order it is, of course, necessary to consider the numbers of married women in the year in question who could have births of each order, i.e. the distribution of women by number of previous children. This information is not in general available. The divergences between the way in which births of different order moved are, however, striking enough in themselves to show a point of importance for the subsequent analysis. The increases in the total number of legitimate births in 1942 and 1943 were due to first, second, and to a slight extent, to third births. The total of fourth and fifth births was slightly higher in 1942 than in 1941 but remained well below the 1939 level. At all orders higher than the sixth (i.e. with five or more previous children) the number of maternities fell

(1) See Note (c).
(2) All subsequent references to "birth-order," "parity" or "previous children" are to be understood in this sense.

from year to year throughout the war. Moreover it is clear that there is no special significance in the case of the higher-order births in the fall between 1939 and 1941. Indeed between 1940 and 1941 when the steepest fall occurred in the total legitimate maternities the number of eighth, tenth and higher-order births hardly fell at all. All this suggests that if recent movements in births are to be explained as the result of family planning this explanation must apply mainly to births of low order. Further it must have been, as would be expected, among the sections of the population with low fertility that childbearing was reduced in the early years of the war and resumed in 1942–43. It is therefore of crucial importance that the figures be separately analysed by birth order at every stage.

18. This conclusion is confirmed by the pre-war history of fertility statistics in England and Wales and by recent developments in many of the demographically advanced countries. Since the middle of the decade before the war there has been a general upward trend in the number of births (and in reproduction rates). This has in most cases been partly and in some cases largely caused by a rise in nuptiality particularly marked at the younger ages. The increases in births occurred largely among mothers with few previous children. This was only in part a consequence of the fact that marriages had been relatively numerous in recent years. Events in England have been further paralleled elsewhere in the violent fluctuations in the numbers of births during the war years. In all cases these have been mainly due to low-order births. It thus seems that the war fluctuations like the previous increases in the birth figures have been due to those sections of the population which had limited their fertility to the greatest extent.

19. The special part played by the sections of the population with a controlled fertility in causing the recent movements in births has a corollary worthy of mention. These sections of the population may be expected to exhibit far more violent fluctuations in fertility under the stimulus of general 'public confidence' than communities of high fertility. Thus the correlation between fluctuations in fertility and the trade cycle seems to be more pronounced in the case of communities with a low fertility than where fertility is relatively uncontrolled(1). It follows that conclusions drawn from the birth data of any one year as to the direction in which the fertility habits of the community are tending will be less reliable in the future than in the past. It will, therefore, become more necessary to make an attempt, in assessing the significance of current birth figures, to allow for the use of birth control to determine the timing of births. The births of one year may be high to make up for the births postponed in a slump. The methods of analysis here applied to the war years may be useful in dealing with the milder fluctuations arising 'normally' out of such circumstances as economic fluctuations.

II. Maternity Rates by Duration of Marriage

20. The first question to which an answer has been sought is: Does the distribution of births by duration provide evidence that the increases in births and reproduction rates in 1942 and 1943 are due to births postponed in 1940 and 1941?

(1) The correlation between the trade cycle and fertility fluctuations has been found by H. Hyrenius to be higher in urban than in rural communities in Sweden; see "*Statistiska Undersökningar Kring Befolkningsfrågan Utförda av 1941 års Befolkningsutredning*" (Stockholm, 1945), p. 192. The same relation (also investigated by correlation technique, though much less carefully) is found to have been considerably closer in England and Wales in 1895–1913 than in 1854–74, by D. S. Thomas, "*Social Aspects of the Business Cycle*" (London, 1925), p. 97.

21. The following table shows the development of maternity rates specified by duration of marriage.

TABLE III(1)

(*a*) Legitimate Maternity Rates by Marriage Duration (per 1,000)

Year	Marriage Duration (completed years)										
	0	1	2	3	4	5	6	7	8	9	10+
1938 ...	271	251	204	177	159	140	121				
1939 ...	252	240	199	174	154	136	119	105	93	83	44
1940 ...	201	228	180	161	140	120	105	93	82	75	42
1941 ...	188	215	168	139	125	110	96	85	77	69	42
1942 ...	191	220	193	169	145	133	118	100	87	79	45
1943 ..	212	235	179	170	154	138	128	114	98	86	47

(*b*) Indices of Legitimate Maternity Rates by Marriage Duration (1939 = 100)

Year	Marriage Duration (completed years)										
	0	1	2	3	4	5	6	7	8	9	10+
1938 ...	107·3	104·6	102·7	101·5	102·7	102·7	101·5				
1939 ...	100 0	100·0	100 0	100·0	100·0	100·0	100 0	100 0	100·0	100 0	100·0
1940 ...	79·8	95·2	90·8	92 4	90·9	88·6	88 0	88·7	88·8	90 2	93·8
1941 ...	74·6	89·9	84·7	79·6	80·8	81·3	80 3	81·3	83·3	83·9	95·8
1942 ...	75·7	91·6	97·1	96·9	94·0	97·9	99·0	95·7	94·0	95·4	101·5
1943 ...	84·0	98·2	90·0	97·8	99·7	101·5	107 3	109·4	105·8	103·6	107·0

22. In the first place it is desirable to observe the changes occurring between the years 1938 and 1939. The rates given for 1938 are less reliable than those for 1939, being based on one-half year's registrations only. They suffice, however, to establish:

(1) That the decrease in fertility between 1938 and 1939 was concentrated mainly on the recently married

(2) That the ' 1939 ' fertility rates may be considered, at durations over ' 2 ', to represent the general level of fertility of the years immediately before the war. As the number of legitimate births per 1,000 married women under 45 remained constant at 110·2 between 1937 and 1938 there is a presumption that fertility rates were not changing rapidly between 1937 and 1938. The 1939 fertility rates may, therefore, not unreasonably be used as a measure of the general level of fertility which would have occurred had there been no war. In order to test whether the postponement of births in the early war years can account for the later rises, it is necessary to have some standard to measure the ' normal ' rate of child-bearing to be expected during the war years.

23. Next, the changes occurring in the war years may be contrasted with the changes occurring between 1938 and 1939. It is immediately obvious that the changes from year to year in the war years—both the declines between 1939 and 1940 (though many of the conceptions resulting in maternities in 1940 took place before the outbreak of war) and between 1940 and 1941 and the subsequent rises—were far more violent than changes between 1938 and 1939. This fact in itself suggests that the declines and subsequent rises in fertility may have been connected

(1) See Note (*d*).

fertility rates had continued in operation. In the bottom part of the table the total fertility experienced is expressed as a ratio of the fertility according to 1939 rates.

TABLE IV

(*a*) Sums of Maternity Rates 1940–1943 up to and Including Years Stated

Year	Marriage duration in 1940								
	0	1	2	3	4	5	6	7	8
1940 . .	201	228	180	161	140	120	105	93	82
1941 . ..	416	397	319	286	251	216	190	170	152
1942 . . .	609	565	464	419	368	316	277	249	
1943	780	719	602	546	483	414	363		

(*b*) Sums of 1939 Maternity Rates, for Comparison with Figures in (*a*) above

Number of years after initial duration	Initial Marriage Duration								
	0	1	2	3	4	5	6	7	8
0 .. .	252	240	199	174	154	136	119	105	93
1	492	438	373	328	290	254	224	197	176
2 ..	690	612	527	464	409	359	316	280	
3 ...	865	767	663	583	514	452	399		

(*c*) Ratio (*a*)/(*b*)

Year	0	1	2	3	4	5	6	7	8
1940	0·80	0·95	0 91	0·92	0·91	0·87	0 88	0·89	0·89
1941	0·85	0·91	0·86	0·87	0·86	0·85	0 85	0·86	0·86
1942 . . :.	0·88	0 92	0 88	0 90	0·90	0·88	0 88	0·89	
1943	0·91	0·94	0 91	0 94	0·94	0 92	0·91		

27. All the figures in part (*c*) of Table IV are less than one. All the maternities occuring up to to the end of 1943 can be fully explained as the results of postponement without the assumption that married couples were having larger families than before the war.

28. It may be asked, further, whether the rises were so distributed between women of different marriage durations as would be expected on the assumption that a major influence on the extent of the fertility increases in 1942–43 was the extent of postponement in 1940–41. This question may be answered by comparing the bottom portion of Table IV with the lower half of Table III.

29. This comparison shows that matching the fertility rates in 1942 and 1943 with those of roughly the same groups of women in 1940–41 introduces a considerable regularity into the pattern of the 1942–43 fertility rates. Whereas the ratio of the 1943 maternity rates by duration (as shown in Table III) to the rates at the corresponding durations in 1939 varied between 0·90 and 1·10, the figures in the last line of Table IV varied only between 0·91 and 0·94.(1)

(1) The range of the figures in the last line of Table IV would be a little narrower than that of the figures in the last line of Table III even if no special significance attached to the way in which the rates are matched in Table IV. If the fluctuations in the rises of the maternity rates were uncorrelated with the fluctuations in the declines, the process of summation adopted in the computation of Table IV would tend to reduce the variation shown in Table III.

30. Moreover as was pointed out in the comments on Table III, if the figures in the bottom line of the table are read from left to right there is a steady rise from duration 2 to duration 7, followed by a fall to duration 9. This pattern is completely absent from the last line of the lower portion of Table IV. It may be concluded that the "postponement hypothesis"—the assumption that the rises in fertility match the earlier declines—succeeds in explaining the observed variations in fertility rates.

31. Indeed, the variation in the figures in Table IV is probably greater than it would be if the available data made possible a more accurate estimate of the population of married women. For the rates summed in any one column of the top portion of Table IV are all dependent on populations deriving from the same group of marriages. If these marriages have been wrongly estimated all the rates summed in any one column will contain an error in the same direction.(1) Moreover the marriages wrongly allocated will result in a corresponding error in the opposite direction in a neighbouring column.

32. It is however necessary to take account of the effect of the absence of husbands on service overseas. The estimates referred to in para. 7 make a rough allowance for this factor possible. If this allowance is made—on the assumption that none of the husbands absent in the period relevant to the maternities of 1942 returned to have children in 1943—the bottom line of section (*c*) of Table IV would read from left to right:

0·94, 0·97, 0·94, 0·97, 0·97, 0·94, 0·93(2)

All the figures are still less than one. Even if separations are taken into account, this analysis reveals no group of women (as defined by marriage duration) who in the years 1940–43 had more births altogether than would have been expected on the basis of the 1938 fertility. The "postponement" hypothesis can account for the whole increase in fertility rates in 1942 and 1943.

33. To sum up the discussion of Section II, the main conclusions may be listed:

(*a*) The 1939 fertility rates may reasonably be used for the purposes of this analysis as a measure of the general level of fertility that would have obtained had there been no war.

(*b*) The course of the maternity rates by marriage duration is in agreement with the hypothesis that many married couples decided to have in 1942 and 1943 children which they would have had in 1940 and 1941 if, in those years, they had maintained the pre-war habits of married couples of corresponding marriage durations.

(*c*) This "postponement" hypothesis fully explains the high level of the fertility rates in 1942 and 1943.

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(1) There is some slight reason for supposing that the group of marriages relevant to the births at duration 0 in 1938, 1 in 1939, 2 in 1940 etc., has been slightly overestimated. In that case all the rates relating to this group of women would be too low. This would fit in well with the fact that in section (*c*) of Table IV the figures in the columns for duration 2 in 1940 are lower throughout than the figures in the neighbouring columns. A similar statement applies to the figures in the column for duration 2 in Table VII below. The assumption that this group of rates has been underestimated also agrees well with the run of the figures in Table III and in Table V and VI below, if the appropriate diagonal lines of rates are observed.
The groups of marriages relevant to the births at duration 0 in 1939 and 1940 have perhaps been underestimated. On the other hand the marriages from which the populations at duration 0 in 1941, duration 1 in 1942 and duration 2 in 1943 were derived appear to have been slightly overestimated. If these suppositions were to be correct, they would explain, for example, why in Table III the maternity rate for duration 2 appears lower in 1943 than in 1942.

(2) See note (*f*).

III. Maternity Rates by Duration of Marriage and Order of Birth

34. The points discussed in Section II become more striking if the developments are examined separately for each order of birth. It is possible to split the rates in Table III into parity components according to the distribution by birth-order of the maternities occurring at each duration. This has been done in Table V. The rates in Table V therefore represent the result of dividing the births of given order to women of given marriage duration by the population of married women at that duration. It should be noted that the populations used are not specific by the number of children the women have already had. Thus the rates in Table V are not "true" birth-order rates, and the rate of first maternity at duration "7" in 1943, for example, as given in Table V, is the resultant of two essentially different influences. It depends on the proportion of women who had remained childless after 7 years of marriage as well as the rate at which the childless women were having children. It follows that the fact that this rate is higher in 1943 than 1939 does not in itself show that the rate at which childless women were having their first births in the eighth year of marriage had increased. The rise in the rate may mean merely that a greater proportion of the women who had completed seven years of marriage were childless in 1943 than in 1942. Thus the rates in Table V show the results of the past low level of fertility, but it is not possible to deduce from it whether women with the same number of previous children at a given marriage duration were having children faster than they would have had at pre-war rates.

35. Attention may again be directed in the first instance to the changes taking place between 1938 and 1939. In the case of first and second maternities the statement made above (para. 22) holds. Apart from marriage durations '0' and '1' there were no substantial changes in maternity rates between 1938 and 1939. In the case of fourth, fifth and higher-order births there were decreases at all durations; in most cases very substantial decreases.

36. If the changes in the war years are compared with the changes between 1938 and 1939 a contrast is again found between first and second maternities and births of high order in accordance with the conclusions of Section I. The rates of the latter (number of previous children 3 or more) decreased between 1939 and 1940 by amounts of the same order of magnitude as the decreases between 1938 and 1939. The declines occurring between 1939 and 1941 in the rates of births of high order largely represented a continuation of the pre-war process. Births of high order were being eliminated by the increasing practice of birth control. It is not to be expected that declines in fertility rates due to this cause would be subsequently made good. In fact fertility rates continued to decline throughout 1942 and 1943 (except the rate of fourth births at duration 10 and over).

37. Without further sub-division of the population in the duration group '10 and over' it is not possible to see exactly what happened in regard to fourth and fifth births at the points where significant increases might have occurred. It is unlikely, however, that there were increases of importance in fifth-birth rates. The fact that the rates of high-order births at high durations declined far less than at low durations is easily explained. It is a natural accompaniment of the spread of family planning that births are spaced at greater intervals. Thus as high-order births get rarer, they occur more and more frequently after long periods of marriage. For sixth and higher-order births the rates decreased at all ages; but the decreases, which were no faster between 1939 and 1941 than between 1941 and 1943, were proportionately smaller at the longer durations (see Table VI).

TABLE V(1)

Maternity Rates by Duration of Marriage and Number of Previous Children per 1,000 Women of Appropriate Marriage Duration

Previous Children	Year	Marriage duration										
		0	1	2	3	4	5	6	7	8	9	10 +
0	1938	265·0	209·9	108·1	67·3	44·7	28·9	19·2	—	—	—	—
	1939	248·3	199·0	108·1	68·2	43·3	29·0	19·4	13·6	9·4	6·8	2·4
	1940	198·7	191·9	95·7	61·1	38·6	24·7	16·7	11·6	8·2	5·8	2·3
	1941	186·2	191·0	93·4	52·3	35·1	23·8	15·4	11·1	7·7	5·6	2·3
	1942	188·8	199·3	128·0	77·7	50·3	35·3	23·9	15·7	10·9	8·2	2·4
	1943	209·3	213·7	119·9	87·6	58·3	40·4	30·9	21·3	15·0	10·8	3·0
1	1938	—	38·7	86·4	81·4	72·2	58·8	45·4	—	—	—	—
	1939	—	38·8	81·7	80·5	70·6	58·6	46·4	36·0	27·8	21·4	5·7
	1940	—	34·5	76·3	75·6	63·9	50·8	39·5	30·1	23·4	18·2	5·1
	1941	—	23·2	68·1	65·6	56·5	45·1	35·0	27·2	21·7	16·9	5·3
	1942	—	19·5	60·5	72·9	64·1	57·6	48·4	36·6	28·3	21·6	6·6
	1943	—	20·7	55·1	68·8	67·4	60·9	54·7	46·2	36·1	28·1	8·2
2	1938	—	—	8·8	24·5	32·7	35·3	32·6	—	—	—	—
	1939	—	—	8·2	22·7	31·8	33·1	31·3	28·0	25·0	21·6	7·5
	1940	—	—	7·8	21·4	29·6	29·9	28·6	25·9	22·7	20·3	7·3
	1941	—	—	6·3	18·5	26·4	28·3	27·2	24·6	22·7	19·4	7·8
	1942	—	—	4·1	16·3	24·8	28·6	28·2	26·8	24·0	22·0	8·9
	1943	—	—	3·5	12·7	23·2	26·6	27·3	27·1	24·5	22·1	9·7
3	1938	—	—	—	3·1	7·7	12·9	16·4	—	—	—	—
	1939	—	—	—	2·4	7·4	11·8	15·4	16·3	15·8	15·0	7·0
	1940	—	—	—	2·3	7·0	11·7	14·0	15·4	14·9	14·7	6·8
	1941	—	—	—	2·0	5·9	10·5	12·7	13·9	13·8	13·4	7·2
	1942	—	—	—	1·7	5·0	9·2	12·5	13·3	13·5	13·8	7·6
	1943	—	—	—	1·0	4·3	8·0	10·6	12·8	12·9	12·7	7·8
4	1938	—	—	—	—	1·0	3·0	5·7	—	—	—	—
	1939	—	—	—	—	1·0	2·7	4·9	7·5	9·5	9·8	6·0
	1940	—	—	—	—	1·0	2·7	4·5	6·9	8·1	9·1	5·7
	1941	—	—	—	—	0·7	2·3	4·2	5·7	7·1	7·7	5·8
	1942	—	—	—	—	0·7	1·9	3·8	5·4	6·7	7·9	5·9
	1943	—	—	—	—	0·6	1·6	3·3	5·1	6·2	7·0	5·9
5 or more	1938	—	—	—	—	—	0·6	1·5	—	—	—	—
	1939	—	—	—	—	—	0·6	1·5	3·2	5·2	8·2	15·7
	1940	—	—	—	—	—	0·6	1·4	2·8	5·1	6·9	14·4
	1941	—	—	—	—	—	0·4	1·1	2·5	4·3	6·5	14·1
	1942	—	—	—	—	—	0·4	1·0	2·3	3·6	5·7	13·5
	1943	—	—	—	—	—	0·3	0·9	1·9	3·6	5·1	12·8

(1) See note (*g*). It will be noticed that rates for maternities with *n* previous children have only been given from marriage duration *n* onwards. There are maternities with *n* previous children registered at earlier marriage durations. This is of course, not necessarily a physiological impossibility as a woman may have more than one maternity in a single year and her children may include multiple births. But it is obvious that a maternity stated as following on 9 previous children in the first year of marriage implies previous illegitimacy or misstatement of some sort. In any case the figures are very small. These rates have therefore been omitted from Table IV. As a result the sum of the rates specific by birth-order in Table IV is sometimes less than the total rate for the corresponding duration of marriage in Table III.

38. By contrast with the high-order births the rates of first and second maternities suddenly dropped very much more steeply between 1939 and 1940 than they had been declining between 1938 and 1939. Correspondingly the fertility rates rose in 1942 and 1943. Everything is consistent with the supposition that first and second births, which are substantially due to the low fertility sections of the population, were postponed under the stimulus of the fears of the early war years. Subsequently the parents who would normally have had their children earlier decided to have their families in 1942 and 1943.

39. Third births occupy an intermediate position between the first and second births and those of fourth and higher orders.

40. The contrast between the low and high-order births comes out more clearly in Table VI which gives the rates in Table V in index form. The corresponding rate for each duration and birth-order in 1939 has been used as a basis.

TABLE VI

Indices of Maternity Rates by Marriage Duration and Number of Previous Children (1939 = 100)

Previous children	Year	Marriage duration										
		0	1	2	3	4	5	6	7	8	9	10 +
0	1939	100	100	100	100	100	100	100	100	100	100	100
	1940	80	96	89	90	89	85	86	85	87	84	93
	1941	75	96	86	77	81	82	79	82	82	82	95
	1942	76	100	118	114	116	122	123	116	116	120	98
	1943	84	107	111	129	135	139	159	157	159	158	124
1	1939	—	100	100	100	100	100	100	100	100	100	100
	1940	—	89	94	94	91	87	85	84	84	85	90
	1941	—	60	83	82	80	77	75	76	78	79	93
	1942	—	50	74	91	91	98	104	102	102	101	116
	1943	—	53	68	86	96	104	118	128	130	132	144
2	1939	—	—	100	100	100	100	100	100	100	100	100
	1940	—	—	95	94	93	91	92	93	91	94	98
	1941	—	—	76	81	83	86	87	88	91	90	104
	1942	—	—	50	72	78	87	90	96	96	102	119
	1943	—	—	43	56	73	80	87	97	98	102	129
3	1939	—	—	—	100	100	100	100	100	100	100	100
	1940	—	—	—	96	95	99	91	95	94	97	97
	1941	—	—	—	81	80	89	82	86	87	90	103
	1942	—	—	—	69	68	78	81	82	86	92	109
	1943	—	—	—	43	58	68	69	79	81	85	112
4	1939	—	—	—	—	100	100	100	100	100	100	100
	1940	—	—	—	—	96	99	91	92	86	93	95
	1941	—	—	—	—	72	85	85	76	75	79	98
	1942	—	—	—	—	72	68	77	72	71	80	100
	1943	—	—	—	—	57	58	68	68	65	71	98
5 or more	1939	—	—	—	—	—	100	100	100	100	100	100
	1940	—	—	—	—	—	98	89	87	97	84	92
	1941	—	—	—	—	—	73	74	78	81	79	90
	1942	—	—	—	—	—	65	66	72	70	70	86
	1943	—	—	—	—	—	55	61	59	69	61	81

41. It may be seen that the drop in the first and second maternity rates between 1939 and 1940 was not only far steeper than the drop in the same rates between 1938 and 1939, but also steeper than the decline in the high-order birth rates. On the average the first-maternity rates of 1940 were about 85 per cent. of those of 1939, whereas the fourth-maternity rates fell to only about 95 per cent. of the 1939 level.

42. Next it should be noted that several features of Table VI agree very well with the postponement hypothesis. For every order of birth the maternity rates of 1942 and 1943 are higher in relation to the 1939 rates at high marriage durations than in the early years of marriage. The higher fertility rates relate to marriages which may reasonably be supposed to have had postponed children to ' make up '.

43. The fact that the increases in first-birth rates are far more striking than the increases in second-birth rates is also well in accord with the ' postponement ' hypothesis as it is necessary to make up for first births before ' making up ' second births (in the case of couples who would according to 1939 fertility rates have had a second child by 1943, but had postponed their first).

TABLE VII

Maternities in 1940–43 per 1,000 Marriages Surviving at End of Each Year as Proportion of those Expected at 1939 Rates

Previous children	Up to and including year stated below	Marriage duration in 1940						
		0	1	2	3	4	5	6
0	1940	0·80	0·96	0·89	0·90	0 89	0·85	0·86
	1941	0 87	0·93	0·84	0·86	0·86	0 83	0·84
	1942	0·93	0·97	0·90	0·94	0·94	0·90	0·91
	1943	0·97	1 01	0·96	1·02	1·02	0·99	1·01
1	1940	—	0·89	0·93	0 94	0 91	0·87	0·85
	1941	—	0·85	0·88	0·87	0 84	0·82	0 81
	1942	—	0·87	0 89	0 91	0·90	0·87	0 86
	1943	—	0·89	0·92	0 96	0 96	0·94	0·94
2	1940	—	—	0 95	0·94	0 93	0·90	0·91
	1941	—	—	0·85	0 88	0·89	0·89	0 90
	1942	—	—	0·82	0·87	0 90	0·91	0·92
	1943	—	—	0 81	0 87	0·91	0·92	0 94
3	1940	—	—	—	0·96	0·95	0·99	0 91
	1941	—	—	—	0·84	0 91	0·90	0·88
	1942	—	—	—	0·81	0·87	0 87	0·87
	1943	—	—	—	0·76	0·84	0·85	0·87
4	1940	—	—	—	—	1·00	1·00	0 92
	1941	—	—	—	—	0·89	0·91	0·82
	1942	—	—	—	—	0·83	0·82	0·77
	1943	—	—	—	—	0·76	0·75	0·75
or more	1940	—	—	—	—	—	1·00	0 93
	1941	—	—	—	—	—	0·81	0·83
	1942	—	—	—	—	—	0·76	0·76
	1943	—	—	—	—	—	0·72	0·70

44. To test whether all the increases can be explained by the postponement hypothesis and whether the increases match the deficits of the earlier years, the same procedure has been adopted as in the computation of Table IV. The table given above (Table VII) corresponds to the third section of Table IV. It is based on the number of maternities of each order which different groups of women (defined by their marriage duration in 1940) had had according to Table V by the end of the year stated in the left-hand column. These maternities have been expressed as a proportion of what they would have had, if the 1939 fertility rates had continued in operation.

45. In the first place, it appears from the table that in the case of first and second maternities the rising fertility rates of 1942 and 1943 fit in well with the deficits of the earlier years. In the case of first maternities, for example, the 1943 maternity rates at durations '3' to '9' were (as may be seen from Table VI) between 129 and 159 per cent. of the 1939 rates at corresponding durations. If, however, the rises are offset against the deficits of 1940 and 1941 it appears that each of the groups of married women which can be traced through the war years had in those years between 96 and 102 per cent. of the births which they would have had had the 1939 rates continued in operation. It is probable, as was pointed out in paragraph 31, that if the populations used were more accurate, the offsetting of the rises against the deficits would show the behaviour of the different groups of women to be even more uniform. The 'postponement' hypothesis clearly succeeds in explaining the observed variations in first-maternity rates in a satisfactory manner.

46. Moreover the figures in Table VII for the years before 1943 show that the 'postponement' hypothesis is in good agreement with the fact at *each* stage of the process up to 1943. Similarly it will be seen that the 'postponement' hypothesis agrees well with the variations in second-maternity rates.

47. The answer to the question whether the 'postponement' hypothesis can account for the *whole* of the rises in the maternity rates, however, appears doubtful on the basis of Table VII. Some of the figures relating to first maternities are higher than one. Certain groups of women appear to have had more first births in 1940–43 than would have been expected on the basis of the 1931 fertility rates. Has childlessness decreased during the war?

48. It seems probable that this is not, in fact, the case so far as the figures up to the end of 1943 are concerned. In the first place the figures are not quite accurate because of the difficulty of estimating populations, as has been mentioned above. The figures in Table VII which are above one may be somewhat overstated (correspondingly there is some reason to suppose that the figures appearing in the column under marriage duration '2' are understated—see paragraph 31). Secondly, it is likely that the 1939 first-maternity rates in the form in which they have been used do not in this instance correctly represent 1939 fertility habits. It appears from figures obtained in connection with widows' pensions(1) that there was an increase in childlessness in the 1930's. The women arriving at say marriage duration '6' in 1939 therefore, probably had a smaller proportion of childless women among them than a group of women who, from their first years of marriage, had experienced the 'true' birth-order rates of 1939. If such a group of women had at marriage duration '6' the same 'true' first-birth rate as was experienced in 1939, they would have had more first births per 1,000 women at marriage duration '6', as more of them had not yet had a first birth. The rates used in computing Table VII thus understate the number of first maternities to be expected on the basis of the family building habits of 1939.

(1) Statistics provided by the Government Actuary's Department.

49. It is probable, therefore, that no group of women (defined by marriage duration), so far as it is possible to trace them, had had more first maternities by the end of 1943 than would have been expected on the basis of the family building habits of 1939. It is nevertheless certain that some of the women were having first children faster than they would have had at the pre-war rates. This is clear if the number of husbands separated from their wives in 1941–1943 is taken into account. Various reasons have been suggested for this phenomenon—such as the desire to avoid labour direction or to obtain release from the Women's Services, or the wish of the husband to leave his wife with a child before going abroad.

50. Whether there has in fact been a decline in childlessness will appear from the results of the Family Census. It may appear that during the war some women, who according to pre-war family building habits would have remained childless, did have a child. If this is the case, it is of course, possible that the phenomenon may be temporary and due to special circumstances connected with the war. Childlessness may thus rise again. In any case, it is not possible on the basis of the figures analysed here to show whether a proportion of the women who would 'normally' have remained childless throughout their lives have had a first child. The only thing which is certain is that some women have had first children faster than they would have done had pre-war family building habits continued.

51. In the case of second maternities none of the figures in Table VII are above one. This remains true if account is taken of the absence of husbands(1). In that case the line in Table VII relating to 1943 and referring to second maternities should read, from left to right:

0·93, 0·95, 0·98, 0·97, 0·96

52. So far as the analysis can be carried, the 'postponement hypothesis' explains all second maternities up to the end of 1943. The same applies to all maternities of higher order, where the proportions in Table VII are very much below one.

53. The discussion of Tables V, VI and VII has thus shown that:

(*a*) The elimination of large families, illustrated by the decline in high-order birth rates, has gone on throughout the war years, in smooth continuation of the process traceable in the pre-war figures for 1938 and 1939.

(*b*) In the case of first, second and third births the war resulted in sudden changes which do not appear as a continuation of pre-war developments.

(*c*) The figures examined support the hypothesis that some 'making' up of postponed births took place in 1942 and 1943.

(*d*) The 'postponement' hypothesis cannot fully explain the rises in first maternity rates in 1942 and 1943.

(*e*) Married women in 1942 and 1943 were having first maternities faster than they would have done if the 1939 maternity rates had continued in operation.

IV. Average Marriage Duration at Maternity

54. A useful method of summarising the distribution of births by duration of marriage is to calculate the average duration of marriage at which births occur. To compute the average duration at which the maternities of a given year occurred and to follow the changes in this average over a number of years is however only illuminating after a period in which the yearly number

(1) See Note (*h*).

of marriages has been fairly constant(1). In a period in which the number of marriages is rapidly increasing the unstandardised average of the durations at which maternities occur may well decrease even if married couples are in fact deferring childbearing (simply because the proportion of recently married among the population of married women is increasing).

55. It is possible to improve on a simple average of the durations at which maternities occur by taking the parity of the maternities concerned into account. For the children borne by couples who have been married longer are likely to be on the average of higher parity than the children of the newly-wed. The calculation of which the results are given in Table VIII was based on this consideration. The total duration of the marriages of the women who had children in a given year was calculated. The number of children born before the current maternity was then computed from the statements of ' previous children '. To this figure was added the number of births implied by the maternities considered. The total duration of marriage was then divided by the total number of children obtained as explained. The result gives in years the average intervals at which the mothers who had children in a given year had been having children since their marriage. Ante-nuptially conceived children were excluded from this calculation.

TABLE VIII(2)

Average Years of Marriage per Birth of Women who had a Maternity in Stated Years

Year of Maternity	1939	1940	1941	1942	1943
Average number of years per birth	2 4	2·4	2·5	2·6	2·7

56. The method of calculation adopted, however, only partly excludes the disturbing factors resulting from the changing distribution of the population of married women by marriage duration. For, on the whole, women bear children more quickly in the early years of marriage (this is shown by the fact that fertility rates decrease with increasing marriage duration). The figures might, therefore, be expected to decrease. The women who had births in 1943 had, on the whole, been more recently married than the women who had borne children in 1939. The former group of women would therefore be expected to have borne children at more frequent intervals in their past married life. In fact, as may be seen from the table, the average number of years of past married life per child of the women who had children in 1943 exceeded the 1939 figure by more than ¼ year. This may therefore be taken as a minimum figure for the average length of time by which women who had maternities in 1943 had prolonged the period of marriage after which they had them, compared with pre-war habits.

57. It is next necessary to make a separate analysis of the average marriage duration of births of each order. The total duration of marriage of the mothers who had maternities of different parities was divided by the total number of maternities. The resulting average durations of marriage are given in Table IX.

(1) Strictly speaking it is also necessary to assume that the rates at which fertile marriages are dissolved (by death of husband or wife, divorce, or wife reaching end of childbearing period) have remained constant. In practice variations in this factor are not likely to be important in the short period as compared with variations in the number of marriages.

(2) See Note (*i*).

TABLE IX

Average Marriage Duration in Years Elapsing before Maternities of Different Order (unstandardised)

Number of previous children	1938	1939	1940	1941	1942	1943
0(1)	2·73	2 76	2·74	2 52	2·87	3·14
1	5 13	5·18	5 11	5 24	5·52	5·85
2 ...	7·53	7·57	7·24	7 88	8·14	8·34
3 ...	9 53	9·58	9 60	9 88	10 06	10·32
4 . ..	11 17	11·23	11 32	11 60	11·71	11·88
5 ..	12 63	12 62	12·69	12 99	13 11	13·25
6	13 92	13·90	13·97	14 21	14 45	14 41
7	15 05	15·12	15 25	15 26	15 43	15 65
8	16 08	16 17	16·48	16 62	16 75	16 68
9	17·26	17 31	17·53	17 71	17·80	17 54

58. The figures for 1938 (July to December only) and 1939 agree closely. The results for the war years are slightly irregular in parts. As births of different parity take place, on the whole, at different marriage durations, the changes in the constitution of the population of married women by duration of marriage affect the figures in Table IX in different ways according to the parity. Thus the decrease in the average marriage duration before the first birth in 1941 while the figures for second and third births increased is due to the fact that the rush of marriages in 1939 and 1940 resulted in a considerable number of young married couples having first, but not yet second, births in 1941. Owing to the steady rise in the annual number of marriages since 1932 all the figures in the table (except, perhaps, those for very high birth orders) are too low, as the population is abnormally weighted in favour of the comparatively recently married. The war marriages only aggravate this difficulty.

59. The general trend, however, is clear. Births of whatever order, in 1942 and 1943 occurred after more years of marriage than before the war. In general but little lengthening of the average duration is noticeable by 1940. In 1941 for most orders of birth the average duration since marriage had increased, a reflection of the fact that fertility rates at shorter durations had on the whole fallen more than those at later durations. It is possible that some of the pregnancies embarked on in the early months of 1940, the optimistic period of the 'phoney' war, had been postponed at the outbreak. The changes between 1939 and 1943 have been summarised in Table X.

TABLE X

Increase from 1939 to 1943 in Average Duration in Years of Maternities of Different Parities (unstandardised)

Number of previous children	Increase in years	Increase as proportion of 1939 figure
0	0·38	·138
1	0 67	·129
2	0·77	·102
3	0·74	·077
4	0·65	·058
5	0·63	·050
6	0 51	·037
7	0·53	·035
8	0·51	·032
9	0·23	·013

(1) First maternities ante-nuptially conceived have been excluded.

60. The table shows that proportionately to the average pre-war interval since marriage the average duration at which the higher-order births occurred increased far less than the marriage duration of births of low parity. The largest absolute increase occurred in the case of third births. The small lengthening of the period in the case of the very high-order births was probably more part of the general process of the spread of family planning (and consequently the spacing of births) rather than a special war phenomenon. In any case it is again apparent on the basis of this table that those who were having births of low parity (i.e. those sections of the population whose fertility was low) reacted more sharply to the war than those whose fertility was relatively uncontrolled.

61. Another result of the fact that high-order births are due to a large extent to a different section of the population from that which produces the births of low parity appears in the differences between the marriage durations at which births of successive parities occur. These differences, obtained by subtracting each figure in Table IX from that referring to the parity above it, have been set out in Table XI for each year from 1939 to 1943. Thus the figure entered in the table as the interval that elapses before the third maternity after the second birth is, according to the 1939 figures, the difference between the value for second and for third maternities in 1939, i.e. 7·57–5·18 = 2·39. The interval between marriage and first birth, excluding ante-nuptially conceived children, has been added in the first line of the table.

TABLE XI

Mean Difference in Years Between Average Duration at Births of Different Orders, 1939–1943

Number of previous children	Mean interval before next maternity after reaching number of children in adjacent column (see para. 61)				
	1939	1940	1941	1942	1943
0	2·76	2·74	2·52	2·87	3·14
1	2·42	2·37	2·72	2·65	2·71
2	2·39	2·13	2·64	2·62	2·49
3	2·01	2·36	2·00	1·92	1·98
4	1·65	1·72	1·72	1·65	1·56
5	1·39	1·37	1·39	1·40	1·37
6	1·28	1·28	1·22	1·34	1·16
7	1·22	1·28	1·05	0·98	1·24
8	1·05	1·23	1·36	1·32	1·03
9	1·14	1·05	1·09	1·05	0·86

62. Figures obtained in this way do not of course represent the time elapsing between the successive maternities of any one group of women. In the first place the column of figures for any one year represents a cross-section of the experience of women who married at very different times (women with fifth or higher-order maternities were on the average married more than 10 years ago). Secondly (and this is the more important point) women who will later go on to have very large families form only a slight proportion of those who have births of low parity at any one time. This is the reason why the average intervals between births of successive parities decrease with increasing parity. Individual women on the whole probably have children at shorter intervals in the early years of marriage than in the later years. But the very fertile women, though their fertility is also greater in their earlier than in their later years of marriage, yet have children in more rapid succession, taking their childbearing

period as a whole, than the women of low fertility. Thus women who have eight children take less than twice as long to have them than women who have four children. This is probably partly the result of biological influences, as the more fecund women presumably conceive more easily, partly the result of the fact that birth control is used both to limit total fertility and to space children.

63. It will be noticed that the 1943 figures show longer intervals between the first and second, and between the second and third births than the 1939 figures. For higher parities the figures in Table XI are lower for 1943 than for 1939. This is another aspect of the difference in behaviour between the groups of low fertility and those of high fertility.

64. Where the population of women of different marriage durations is known, it is obviously possible to use the fertility rates by marriage duration obtained from them to derive an average marriage duration at which maternities of given parity occur. The fertility rates given in Table V for each year from 1939 to 1943 have been applied to a standard population of married women by duration (that given in the Note by the Government Actuary's Department on Standardised Reproduction Rates). The average durations, at which the maternities thus obtained would occur, are given in Table XII. The index thus obtained is obviously unaffected by changes in the composition of the population of women by marriage duration. Unfortunately, the larger part of maternities of higher order than the fourth occur after more than 10 years of marriage. No maternity rates by duration are, however, available for durations over 10. It is for this reason that it has been necessary to enter into the discussion of unstandardised rates. It is, however, specially important to use standardised rates for the low parities, as the figures for these are affected by the particularly violent disturbances introduced by the marriages at the beginning of the war. This source of disturbance is less important for births of higher orders.

TABLE XII(1)

Standardised Mean Interval since Marriage of Maternities of Different Parity

Number of previous children	Mean interval of maternities according to rates of stated years				
	1939	1940	1941	1942	1943
0(2)	2·97	2·94	2·95	3 10	3·26
1	5·49	5·43	5·67	6·02	6·34
2	7·89	7 98	8·27	8·58	8·85
3	9·84	9 89	10·21	10·42	10·70

65. The figures in Table XII are all, as was to be expected, higher than the corresponding figures in Table IX. In the main they confirm the picture already given. Substantial increases occurred in the average durations before births of each order. The average duration before first births rose between 1941

(1) See Note (j).

(2) Ante-nuptially conceived children have again been excluded. If they are included the figures are as follows:—

2 46, 2·51, 2·51, 2·73, 2·88.

The fact that during the war a far smaller proportion of brides were pregnant at marriage than before the war resulted in a considerable lengthening of the average period between marriage and first maternity. The figures for first maternities in Table XII are not affected by this phenomenon.

and 1943. For higher orders the average duration also rose somewhat between 1940 and 1941. The differences between the durations at which births of successive orders occur decrease with increasing parity as in Table XI. From 1939 to 1943 the difference between the average interval after marriage of first and second and of second and third births increased (from 2·52 and 2·40 to 3·08 and 2·51 respectively). The interval between third and fourth births decreased. The main new feature revealed by Table XII is that the increase in the average interval after marriage at which second births took place was greater, proportionately to the 1939 level as well as absolutely, than the postponement in the case of first births.

66. It should be remembered that the increases in the figures in Table XII for second maternities do not show by how much married couples who had had their first birth postponed the second. It only shows the amount by which the total average interval between marriage and second maternity increased—a figure which is affected by the postponement of the first births after which the second births entering into the table occurred. A similar statement applies to births of higher parity.

V. Family Size

67. It is possible to use the process of summing the maternities of women in successive years and at successive marriage durations (the process which has been used to construct Tables IV and VII) for a further purpose. If the process is begun at duration 0 and the births of various orders summed separately down the years it is possible to obtain a picture of the sizes of family attained by the recently married women by the end of 1943. The summation has been carried out in a way analogous to that described in para. 26. Rates of different parities (those given in Table V) have been summed through the years to give the total number of maternities of that parity to, say, 1,000 surviving marriages (where the wife is under 45) at the end of the period. The subtraction of the total number of first maternities from 1,000 then gives the number remaining childless out of 1,000 married survivors. Thus it may be seen from Table V that every 1,000 women at marriage duration 0 in 1942 had 188·8 first maternities, at marriage duration 1 in 1943 they had 213·7 first maternities. Thus by the end of 1943 this group of women had altogether had 402·5 first maternities. The proportion still remaining childless at the end of 1943 was therefore 1·000 − 0·403 = 0·597. Similarly by subtracting the total number of second maternities to this group of women by the end of 1943 from the total of first maternities we may obtain the number who had had one child and one child only.(1) By a similar process the proportion of women with other sizes of family is obtained.

68. In the table given below the figures have been so arranged as to show the position of women of various marriage durations at the end of 1943. As the data collected under the Population (Statistics) Act which make this process possible have been available only since 1938, the number of marriage durations for which it has been possible to obtain figures is small. It has been thought worth while to give figures which, strictly speaking, require for their construction a knowledge of the fertility rates of 1937 and even 1936 by birth-order and duration of marriage. This has been done because the figure obtained by this process for the proportion of women who at any time have two and only two children depends mainly on the number who have had a second and the number who have had a third maternity (it also depends

(1) In practice the process is complicated slightly by the necessity of allowing for multiple births.

to some small extent on those who have had twins at their first maternity). As only a very small number of women have second maternities in their first year of marriage, it was thought worth while to use a set of assumed fertility rates for duration '0' in 1937, and thus make possible the utilisation of the known rates for duration '1' in 1938 and '2' in 1939, etc. Similarly, as there are very few third births in the first two years of marriage, it was thought worth while to use assumed rates for duration '0' in 1936, '1' in 1937 in conjunction with the known rates for duration '2' in 1938, '3' in 1939, etc. It was thus possible to get figures for the distribution by family size of women who had completed their seventh year of marriage by the end of 1943. All the figures thus obtained have been included in the table, but, of course, the figures for childlessness and one-child families in the last two lines of the table must be understood to rest on a somewhat less certain basis than the rest.

TABLE XIII(1)

Married Women of Varying Duration of Marriage by Number of Children Born (live or still) by Present Husband by the End of 1943

Years of marriage completed	Proportion of married women with number of children shown below						
	0	1	2	3	4	5	6 or more
1 ...	0·788	0·207	0·004	—	—	—	—
2 ..	0·596	0·378	0·025	0·001	—	—	—
3 ..	0·493	0·426	0·076	0·005	—	—	—
4 ..	0·392	0·447	0·141	0·018	0·001	—	—
5 .	0·327	0·420	0·202	0·043	0·006	0·001	—
6 ...	0·292	0·390	0·234	0·067	0·014	0·002	0·001
7 ..	0·249	0·374	0·259	0·088	0·024	0·005	0·002
8 ..	0·234	0·344	0·270	0·104	0·035	0·009	0·004

69. The table shows in a variety of ways how small was the family size of the women to whom it refers. In the first place, it is obvious that the proportion childless was very high. After the fifth year of marriage about 3 out of every 10 women were still childless. In spite of the abnormally high first-birth rates at high durations of marriage in 1942 and 1943 (which were commented on above) almost one-quarter of the married women seemed still to be childless at the end of their eighth year of marriage (though this figure is somewhat less certain than that quoted for the fifth year of marriage above. Of the sizes of families reached in the first few years of marriage the "one child" family was by far the most frequent. But of course most of the families involved were still incomplete. Only about 15 per cent. of the women had had three or more children before the end of their eighth year of marriage. A couple who had their first child in the second year of marriage and the third in the last year would have had an average interval of 3 years between the births. To have had 3 children by marriage duration '7' does not therefore imply a rapid rate of childbearing.

70. The figures in Table XIII may be compared with roughly analogous figures computed from the results of the German Fertility Census of 1933. The results are given in Table XIV. They may be helpful in appreciating the level of fertility implied by the figures for England and Wales.

(1) See note (*k*).

TABLE XIV

Married Women under 45 at German Census of 1933 with Various Sizes of Family

Completed years of marriage	Proportion who had borne number of children shown below					
	0	1	2	3	4	5
1 .	0 692	0·277	0·029	—	—	—
2 .	0 494	0·424	0·072	0·009	—	—
3 .	0·371	0·461	0·141	0·023	0·004	—
4 .	0·312	0·435	0·195	0·047	0 009	0 003
5 ..	0·269	0 403	0·229	0·074	0 020	0·006
6 ..	0·238	0·371	0·250	0·097	0 032	0·013
7 .	0·213	0 340	0·263	0·116	0·046	0·023
8 .	0·194	0·314	0·270	0·129	0·057	0·036

71. The figures show the situation after German fertility had reached its lowest point. On the other hand fertility in Germany had been falling very rapidly, so that the marriages of the middle 1920's included in the table originated in a period of fairly high fertility. It will be seen that proportions childless are lower throughout, and proportions with more than 2 children higher throughout, than in Table XIII (if figures for the same marriage duration are compared). The recently married women in England and Wales had had very small families by the end of 1943.

72. Next, the figures giving the proportions of married women who had attained given sizes of family may be used to trace the movement of family size throughout the war years. For this purpose it is convenient to compare the " achievements " of successive generations of women married in different years after the same number of years of marriage. Thus the family size attained after their first six years of marriage by the women marrying in 1938 may be compared with the " achievement " in a period of the same length of the women married in 1936. If it were found that the more recently married women were having larger families than their predecessors, then the downward trend in family size could be said to be reversed.

73. Table XV shows the " achievement " in the first few years of marriage of women marrying in successive periods. The " birth achievement " has been shown by means of three indices: the proportion childless, the proportion who have had two or more and the proportion who have had three or more children. The columns of the table correspond to various groups of women identified by the year in which they were at marriage duration ' 0 '. Each horizontal line shows the birth achievement of the women by the end of various marriage durations. The diagonals from bottom left to top right consequently show the figures for the same calendar year (e.g. for 1943 when the women who had been in marriage duration ' 0 ' in 1942 were at duration ' 1 ', those at duration ' 0 ' in 1941 were at duration ' 2 ' etc.).

74. In comparing the family sizes of successive generations of married women through the war years it is necessary to remember that fertility rates decrease with increasing duration of marriage.(1) This in conjunction with the " postponement " and " making up " of the war years disturbs the comparison between successive generations of married women. Thus women who married later and were affected by the war at shorter durations than the women who married earlier, lost more births. On the other hand the women

(1) This is true of " true " birth-order rates relating to all parities (see para. 86 below). The rates in Table V increase at first in the case of high-order births because there are few women with the requisite number of previous children.

who married later also recovered more births in 1942 and 1943 as they experienced the recovery at earlier marriage durations than the women who married earlier. It is therefore difficult to draw conclusions as to the ultimate family building habits of the women entering into the table. Thus the women who have had all their fertility experience in 1942 and 1943 have obviously at the end of duration '0' and '1' a smaller proportion childless than the women whose first and second year of marriage fell in 1940 and 1941. At the same time the proportion childless at the end of the first or second year of marriage was in the case of those recently married women much higher than in the case of women married before the war. This is true even if the effect of the absence of husbands overseas is taken into account. The increased childlessness of recently married women after the first few years of marriage is due mainly to the drop in the rates of ante-nuptial conceptions.

TABLE XV

Distribution of Families by Size

(*A*) *Proportion of Childless Women*

Completed years of marriage	Date of '0' duration							
	1936	1937	1938	1939	1940	1941	1942	1943
1	(0·728)	(0·729)	0·729	0 748	0·799	0 812	0 809	0·788
2 . .	(0·518)	(0·520)	0·530	0·556	0 608	0·613	0 596	—
3	(0·420)	(0·411)	0·435	0·463	0·480	0·493	—	—
4	(0·342)	(0·350)	0·382	0·385	0·392	—	—	—
5	(0·303)	(0 315)	0·332	0·327	—	—	—	—
6	(0·279)	(0·280)	0 292	—	—	—	—	—
7	(0·255)	(0·249)	—	—	—	—	—	—
8	(0·234)	—	—	—	—	—	—	—

(*B*) *Proportion of Women with* 2 *or more Children*

Completed years of marriage	Date of '0' duration						
	1936	1937	1938	1939	1940	1941	1942
2	0·049	0·049	0·049	0·042	0·029	0·025	0·026
3	0·136	0·133	0·126	0·111	0 091	0·081	—
4	0 217	0·208	0·192	0·185	0·161	—	—
5	0·282	0·265	0·257	0·253	—	—	—
6	0·327	0·322	0·318	—	—	—	—
7	0·375	0·377	—	—	—	—	—
8	0·431	—	—	—	—	—	—

(*C*) *Proportion of Women with* 3 *or more Children*

Completed years of marriage	Date of '0' duration					
	1936	1937	1938	1939	1940	1941
3	0·013	0·012	0 012	0·010	0·006	0 005
4	0 037	0·035	0·031	0·027	0 020	—
5	0·067	0·062	0·057	0·051	—	—
6	0·096	0·091	0·084	—	—	—
7	0·125	0·119	—	—	—	—
8	0·151	—	—	—	—	—

75. On the other hand the women of marriage duration '0' in 1938, 1939, 1940 or 1941 who felt the impact of the war early on in their marriages when their fertility would normally have been at its highest showed a higher proportion of childlessness than their predecessors. It may be seen from the table that after marriage durations '2' and '3' each succeeding generation of married women showed a higher percentage of childlessness than the previous one.

76. It will thus be seen that all the changes can be explained as the effects of the "postponement" hypothesis. No evidence can be found as to a long term increase or decrease in childlessness.

77. In the other two sections of Table XVI the effect of rising fertility rates in 1942 and 1943 can hardly be seen at all. At each duration every succeeding generation of women shows a lower proportion with the requisite number of children. This is another illustration of the gradual disappearance of the women with high fertility, who bear children rapidly.

VI. "True" Birth-Order Rates

78. It is possible to study some of the movements of the "true" birth order rates through the war by means of various estimates of a not too reliable character. It is first necessary to trace the true fertility of women in their first year of marriage. The fact that the proportion of brides pregnant at marriage decreased at the beginning of the war tended to raise the proportion of marriages having a maternity at 9–11 months' duration. This distorting influence must be excluded in tracing the course of family planning during the war years. Unfortunately it is not possible to do this with the accuracy that would be desirable. The general picture may, however, be regarded with fair confidence.

79. Table XVI shows the rates obtained by relating the first maternities at marriage duration '9–11 months' to the number of women who married at relevant ages in the appropriate period, after excluding from them (on the basis of the figures in Table I) those who were pregnant at marriage.

TABLE XVI(1)

Rates of Post-nuptially Conceived First Maternities in First Year of Marriage per 1,000 Relevant Marriages

Age Group	Year of maternity				
	1939	1940	1941	1942	1943
16–19	202	134	125	124	145
20–24	127	109	92	106	113
25–29	102	92	80	93	103
30–34	99	93	84	93	102
35–39	69	64	65	66	73
40–44	25	24	22	21	25

80. The table shows that the proportion of those conceiving in the first three months of marriage fell most heavily at the younger ages in 1940 and 1941. The recovery in 1942 and 1943 brought the rates for the older ages back to the 1939 level. Below the age of 25 they remained lower than before the war.

(1) See Note (1).

Unfortunately it is not easy to obtain any idea of the effect of the separation of husbands and wives on these figures. It may be that many of the marriages took place because the bridegroom had to go overseas. As this phenomenon was probably more frequent in the case of the younger brides, the effect of separations on the rates in Table XVI for ages under 25 may have been far heavier than for the general population of young women. On the other hand, in many cases where the bridegroom was due to go overseas, he must have stayed in the country for some time after marriage. This consideration suggests that the effect of separations on the maternity rates in Table XVI was less heavy than for the general population of women of the same age.

81. In any case the effect of separations could hardly have been so heavy as to account wholly for the fact that the 1943 rates below 25 were, in contrast to the rates above 25, well below the 1939 level. It would seem that the deficit (compared with the pre-war level) in the fertility of those marrying at young ages was due to the effect of marriages of women who would not normally have married at those ages. On the other hand, separations must have caused some loss of births. It would therefore appear that at the higher ages married women were in 1943 having first maternities more rapidly than before the war. This was perhaps due to the desire to avoid labour direction or the other motives referred to in paragraph 49 above.

82. The next step is to follow the 'true' birth-order rates at higher durations of marriage than the first year as far as the material allows. Such rates may most conveniently be computed by dividing the rate at which maternities of order n occurred to women of given marriage durations (the rates given in Table V) by the proportion of women who when entering upon the year of marriage duration in question had had n–1 children. For example, of the women who in 1942 were at marriage duration '2', 48 per cent. were still childless at the end of that marriage duration (as may be seen from Table XV). The rate at which women at marriage duration '3' had first maternities in 1943 was 88 per 1,000. Thus the rate at which women who at the end of their third year of marriage were still childless had a first maternity at duration '3' in 1943 was $88/0{\cdot}480 = 183$[1]. The 'true' birth-order rates obtained in this way are given in Table XVII.

83. The figures thus give the probability that a marriage which has already produced the number of live or stillborn children stated at the top will experience a maternity within one year of entering upon the marriage duration stated at the side.

84. The rates at the last two marriage durations given for each year are dependent upon the fertility rates assumed for 1936 and 1937, so far as first and second maternities are concerned. They are therefore less accurate than the other figures given.

85. Rates of this kind have not been investigated before, so far as is known (at any rate for England and Wales). It is desirable in the first instance to note some general features of "true" birth-order rates, before passing on to trace the course of these rates through the war years. The general features may most easily be seen in the figures for 1943—for which year rates have been computed up to the eighth year of marriage.

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[1] Denoting maternities born after n previous children at a given marriage duration in a given year by M, and the number of married at that marriage duration in that year by W, the rates given in Table V are M/W. Let the number of those among the W married women who have had n children be denoted by $W(n)$. Then the proportion $W(n)/W$ is given in Table XV (for $n=0$) and $M/W \div W(n)/W = M/W(n)$ is the 'true' birth-order rate.

TABLE XVII

True Birth-Order Rates by Duration of Marriage, 1939–1943 (per 1,000)

Year	Duration of marriage	Number of previous children 0	1	2	3	4
1939	0	248	—	—	—	—
	1	273	148	—	—	—
	2	208	189	180	—	—
	3	167	177	184	209	—
1940	0	199	—	—	—	—
	1	257	140	—	—	—
	2	180	181	171	—	—
	3	149	165	180	211	—
	4	113	145	164	216	—
1941	0	186	—	—	—	—
	1	239	118	—	—	—
	2	168	170	158	—	—
	3	120	149	162	189	—
	4	100	128	153	193	—
	5	79	109	132	190	230
1942	0	189	—	—	—	—
	1	245	106	—	—	—
	2	211	167	147	—	—
	3	168	171	160	198	—
	4	132	151	154	181	—
	5	112	137	141	179	216
	6	86	123	122	171	207
1943	0	209	—	—	—	—
	1	264	111	—	—	—
	2	196	152	146	—	—
	3	183	160	150	179	—
	4	151	157	147	181	—
	5	122	148	133	167	219
	6	111	138	118	149	201
	7	84	125	108	144	187

86. In the first place it may be noted that for each parity the rate for the first marriage duration for which a figure is given is lower than the rate for the next duration(1). But from the second marriage duration onwards "true" birth-order rates decrease throughout with increasing marriage duration for all parities (unlike the rates in Table V).

87. Secondly, a comparison may be made of the rates for the different parities. It is not, of course, correct to compare rates of different parities at the same duration. The 'true' first-birth rate at marriage duration '4' relates to women of low fertility, women who are still childless at the end of their fourth year of marriage. On the other hand the fourth birth rate at duration '4' refers to women of high fertility, women who have had 4 children in their first five years of marriage. It is obvious that for physiological reasons, if no other,

(1) This phenomenon is easily explained. Most first maternities in the first year of marriage occur at a duration of '9–11 months'. This means that there can hardly be any second maternities in the first six months of the second year of marriage duration. Thus as it in effect only relates to half a year the second maternity rate at duration '1' is lower than at duration '2' even through the probability of having a second maternity steadily decreases with increasing marriage duration. For a similar reason the third maternity rate at duration '2' is smaller than at duration '3' and so forth.

the rates mentioned are not comparable. If, however, the highest rates for each parity are compared (i.e. the first-birth rate at duration '1', the second-birth rate at duration '2', the third-birth rate at duration '3') or the rates in a similar diagonal at later marriage durations, it is found that the probability of having a first child for a childless woman is higher than that of having a second child in the case of a woman who has already had one child. Similarly the 'true' second-birth rate is higher than the 'true' third-birth rate.

88. On the other hand the 'true' fourth-birth rate is higher than the third-birth rate and the fifth-birth rate is higher than the fourth-birth rate. An obvious explanation suggests itself. The rates for first, second and third births relate mainly to sections of the population with low fertility. The women with very large families contribute only a small proportion to the total number of first, second and third births occurring in a year. On the other hand as we pass on to fourth and fifth births the rates relate increasingly to women of a high fecundity who practise birth control comparatively little. It is natural therefore that the probability of having a maternity within a year is higher for the women who have had fourth births than for the women who have had second births.

89. The facts that the rates for each individual year run smoothly, that the main features mentioned are common to the rates for all the years and that rates for the same parity and duration run smoothly from year to year are an encouraging indication that the rates are trustworthy in spite of the involved process of computation by which they were obtained.

90. Next, the history of the true birth-order rates may be considered as far as the material allows. As rates are available for one more marriage duration in each successive year, it has been thought convenient to express the birth rates of each as proportions of the rates in the preceding year. This has been done in Table XVIII.

TABLE XVIII

True Birth-Order Rates as Percentage of Previous Year's Rates

Year	Duration of marriage	Number of previous children				
		0	1	2	3	4
1940	0	80	—	—	—	—
	1	94	95	—	—	—
	2	87	96	95	—	—
	3	89	93	97	101	—
1941 .. .	0	94	—	—	—	—
	1	93	84	—	—	—
	2	93	94	93	—	—
	3	81	90	90	89	—
	4	89	88	93	89	—
1942	0	101	—	—	—	—
	1	103	90	—	—	—
	2	125	98	93	—	—
	3	140	115	99	105	—
	4	131	118	101	94	—
	5	143	126	107	94	—
1943	0	111	—	—	—	—
	1	108	105	—	—	—
	2	93	91	99	—	—
	3	109	94	93	90	—
	4	115	104	95	100	—
	5	109	108	94	93	102
	6	130	112	97	87	97

91. The results are, in part, somewhat irregular. As rates are available for only a very few marriage durations in 1939, these figures do not shed much light on the decline in fertility. In connection with the rises from 1941 to 1942 and from 1942 to 1943 several interesting features may be noticed.

92. In the first place the rises were almost entirely confined to first and second births and they were more pronounced at high than at low marriage durations. These facts, as already argued in paras. 42 and 43, fit in with the " postponement " hypothesis.

93. Secondly, the increase in first birth-rates was much larger than the increase in second-birth rates, both between 1941 and 1942 and between 1942 and 1943, but particularly between 1941 and 1942. As labour direction of women was introduced in May, 1941, this difference in the rise in the true birth order rates would support the " Bevin babies " hypothesis. The difference is particularly striking since it is likely that a larger proportion of childless women than of women with one child were 'sterilised' by the absence of husbands. On the other hand it should be remembered that it is not correct to compare first and second-birth rates at the same marriage duration. The women who would be expected to display rises in the true second-birth rates because they have a 'backlog' of postponed second births to 'make up' are likely to be at later marriage durations than those who have postponed first births to make up.

94. In regard to fourth and fifth birth rates, so far as they are available, it will be noticed that they decrease more slowly (in most cases) than the rates for corresponding marriage durations and parities in Table V. This was to be expected. Every 1,000 married women at duration '5' in 1943, for example, were having fewer fourth births than 1,000 women at the same marriage duration in 1942 because fewer of them had had third births and because their 'true' fourth-birth rate was smaller(1).

95. It is important to notice that the continuing decrease from year to year in the total number of births of high parities is thus due in part to a continuing decrease in the number of women who have had sufficient 'previous children'. The total number of fourth births to women of given age and duration groups may continue to decrease even if the 'true' fourth-birth rate has become stabilised.

96. The study of 'true' birth-order rates may thus in the future give a significantly different picture of the course of family building habits than the ordinary fertility indices. It might be that 'true' birth-order rates became roughly stabilised or decreased very slowly. Yet the number of births of high parities would continue to decrease fairly rapidly for some time because as a result of the higher fertility of the past, there would still be a larger number of women who had had sufficient previous children than there would be if the stable level of the 'true' birth-order rates had been in operation permanently. In such a situation the ordinary fertility indices, which would be decreasing, would tend to lead to an expectation of a larger decline in the number of births than a knowledge of 'true' birth-order rates would warrant.

97. In view of the small number of marriage durations for which the 'true' birth-order rates so far described are available, it has been thought worth while to obtain another set of such rates by a different and even more uncertain procedure. If the widows applying for new awards of widows' pensions (see para. 48) may be regarded as a random sample, with respect to family size, of

(1) The 'true' fourth birth rate at duration '5' in 1943 was 93 per cent. of the same rate for 1942. The fourth maternity rate in Table V decreased from 9·2 in 1942 to 8·0 in 1943 i.e. to 87 per cent. of its 1942 level.

the total married population in each age group, it is possible to obtain a distribution of married women by size of family. The population of married women in 1939 in each age group has been distributed into those who have had '0', '1', '2', '3', etc., children in accordance with the proportions of the widows of that age group applying for pensions in 1939 who had '0', '1', '2', '3', etc., children. The number of married women in each age group who had first maternities in 1939 was then divided by the number of childless married women thus obtained. Similarly the second maternities were related to the women who had had one child. The same was done for births of higher parities and for the figures for 1940–1943.

98. The resulting rates are assembled in Table XIX. As there are a large number of possible sources of error in the method of computation described, the absolute values of the figures should be regarded with great caution(1). Their comparability with each other may probably be viewed with slightly more confidence.

TABLE XIX

Maternity Rates by Age of Mother and Number of Previous Children (per 100)(2)

Age Group	Year	Number of previous children				
		0	1	2	3	4
20–24 . ..	1939	43	15	15	(12)	—
	1940 ..	35	14	13	(14)	—
	1941 ..	32	12	12	(13)	—
	1942 ...	32	13	12	(13)	—
	1943 .	35	12	9	(8)	—
25–29	1939 ...	25	14	12	15	(20)
	1940 ..	23	12	11	12	(23)
	1941 .	20	11	11	11	(16)
	1942 .	26	13	10	12	(14)
	1943 .	25	14	10	12	(14)
30–34 .. .	1939 .	14	10	8	8	14
	1940 ..	12	9	8	9	13
	1941 ..	10	8	7	10	11
	1942 .	13	10	9	9	12
	1943 .	15	12	8	10	10

99. In comparing the figures in Table XIX with those in Table XVII it must be kept in mind that the differences between the rates for the various age groups reflect in part differences in the constitution of the population in the age groups by duration of marriage. The rates for age group 20–24 may be most nearly comparable to the rates in Table XVII relating to the first few years of marriage. The rates for the older ages may be compared with rates for higher durations. Such comparisons show:

(a) The rates for births of each parity are of roughly the same order of magnitude in Table XIX as in Table XVII.

(b) The rates for second births are lower than those for first births, the third-birth rates again lower than the second-birth rates. On the other hand fourth-birth rates are higher than third-birth rates and the rates for fifth births higher than those for the fourth. This feature is also in agreement with Table XVII.

(1) See Note (m).

(2) Rates in which the estimate of the population at risk was based on less than 100 widows have been bracketed.

(c) The rises between the 1941 and 1943 rates shown in Table XIX fit in with the other material already presented. The rises are confined to first and second births.

The fact that the rises are steeper (and, in the case of high-order births, the declines gentler) in the older than in the younger age groups in part reflects the different constitution of the age groups by duration of marriage (cf. paragraph 42). In part the phenomenon is due to differences between age groups which cannot be explained by the effects of marriage duration (as in Table XVI above). These differences are probably due in part to the effects of the absence of husbands which fall more heavily on the older women, partly to the effect of the abnormal age distribution of wartime marriages discussed in Section I.

100. The rates for high-order births to women aged 30–34(1) probably refer mainly to women of higher marriage durations than any for which comparisons are available on the basis of Table XVII. It is interesting to note that (if the figures are to be trusted) the third and fourth-birth rates have not been decreasing. It may therefore be that the rate at which women over thirty who have already had two children go on to their third and fourth, has already become roughly stabilised (cf. paragraph 96). The fifth-birth rates, on the other hand, decreased even in the age group 30–35.

101. The discussion of 'true' birth-order rates may now be summarised:

(a) Examination of 'true' birth-order rates supports the hypothesis that first and second births were postponed in 1940 and 1941 and made up in 1942 and 1943.

(b) 'True' birth-order rates are not available for marriage durations or age groups where they would throw most light on the frequency of third, fourth or fifth children. So far as they are available it appears that the rates for third and fourth births show no increases in recent years, but have not been declining very rapidly.

VII. "Expected" Legitimate Maternities

102. This paper has so far dealt throughout with fertility rates and proportions of women with various sizes of family. The effect of the various movements of the rates on the total number of legitimate births has not so far been considered. This section discusses the "overall" effect of the war-time fertility movements by contrasting the number of maternities occurring in the war years with the number that would have occurred if women had at each duration of marriage borne children at the rate at which the corresponding "duration group" of women did so in 1939.

103. Table XX shows the maternities obtained by applying to the populations of married women for 1940–1943 the 1939 maternity rates specific by duration(2) and parity (such as in Table V). A special problem arises in regard

(1) For assessing the rate at which women who have borne two children go on to the third (or those who have had three go on to the fourth, etc), the rates for the younger age groups are of little importance because the majority of births of high parities are to older women and because the comparability from year to year of the rates for the younger ages has been affected by the war marriages (cf. para. 7). The average marriage duration of the married women in the age groups under 30 was considerably shortened during the war years.

(2) For durations of marriage over 9 years separate rates were used for each age group. The reason for using 1939 fertility rates specific by duration but not by age in computing the births to be "expected" in 1940–43 if the 1939 fertility habits had continued in operation is stated in para. 15. For marriages of long duration it was however thought important to take account of the age distribution as the proportion of women nearing the upper limit of childbearing age would have an important effect on the fertility of this group of marriages. Rates specific by age were therefore used.

to ante-nuptial conceptions. It would not be correct to apply 1939 fertility rates for the first year of marriage to the marriages taking place during the war, as this would in effect imply that the same proportion of the women marrying during the war was pregnant at marriage as before the war. It was therefore decided to exclude ante-nuptially conceived maternities from the table altogether (both from the maternities occurring and those expected). This exclusion, however, raised a difficulty at subsequent marriage durations. The first-maternity rates in Table V were appropriate to marriages of which the " normal " pre-war proportion had had a first child in the first 9 months of marriage. It was necessary therefore to raise the first maternity rates[1] when applying them to the women who had married during the war. This was done on the assumption that *all* the women marrying *during* the war who were not pregnant at marriage had first maternities at the same rate as the women marrying *before* the war who were not pregnant at marriage. The effect of this procedure may be seen as follows.

104. If the women marrying during the war had had ante-nuptially conceived maternities at the pre-war rate, there would have occurred 65,000 more maternities at marriage duration ' 0 to 8 months ' in 1940–43 than occurred in fact. As a result of raising the fertility rates in the manner indicated in the last paragraph, the total of " expected " first maternities in Table XX is 34,000 higher than the figure which would have been obtained had the 1939 first-maternity rates been used without the adjustment.

105. The table shows the ' overall ' effect of the development traced so far for different sections of the population of married women. Thus it brings out once more the contrast between maternities of different parity. The column giving the ' deficit ' for each individual year shows in the case of first and second maternities that the excess of maternities expected over those occurring increased in 1940 and 1941 and then decreased in 1942 and 1943. Maternities of these parities were first ' postponed ' and then ' made up '. In the case of fourth and higher-order maternities no ' making up ' is noticeable. The excess of ' expected ' maternities over those occurring grows year by year. The deficit of third maternities is somewhat less in 1942 and 1943 than in 1941.

106. Consideration of the number of births expected and that occurring supplies a partial remedy for the gravest defect of the analysis so far presented. For this analysis only reaches to the end of 1943. But this date has no particular significance. The total of births in 1944 was well above the 1943 figure. Can the legitimate births of 1944 and 1945 be explained by the postponement hypothesis?

107. To answer this question Table XXI has been compiled. The first five rows of the table consist of the sums for all parities of the figures in Table XX. The last rows of the table give comparable figures for 1944 and 1945.

108. The table shows that all the maternities of 1944 and 1945 can easily be explained by the ' postponement ' hypothesis. The cumulative deficit of ' postponed ' maternities had reached 187,000 by the end of 1943 and the high total of births in 1944 only reduced this figure by 61,000. The number of maternities occurring in 1945 was slightly less than the number ' expected '. An accumulated ' backlog ' of about 138,000 maternities was thus left to be made up after 1945 if the 1939 fertility rates were to be maintained.

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[1] It was not thought worth while to adjust the maternity rates of second and higher-order births, though the second-maternity rate at duration ' 1 ' must be affected by a decline in the proportion of marriages which have a first birth while they are at duration ' 0 '.

TABLE XX(1)

Maternities of Different Orders Occurring to Married Women at Marriage Durations Greater than 8 months, 1940–43, Compared with those Expected at 1939 Fertility Rates

(thousands)

Number of previous children	Year	Actual	Expected	Excess of Expected over Actual	Cumulative Deficit
0 . . .	1939	199	200	—	—
	1940	197	216	19	19
	1941	209	247	38	57
	1942	248	242	− 6	51
	1943	259	232	−27	24
1	1939	157	157	—	—
	1940	145	163	18	18
	1941	133	170	37	55
	1942	159	179	20	75
	1943	177	183	6	83
2	1939	78	78	—	—
	1940	75	80	5	5
	1941	73	82	9	14
	1942	78	85	7	21
	1943	80	88	8	29
3	1939	42	42	—	—
	1940	41	43	2	2
	1941	40	43	3	5
	1942	41	44	3	8
	1943	40	45	5	13
4	1939	25	25	—	—
	1940	24	25	1	1
	1941	23	26	3	4
	1942	23	26	3	7
	1943	23	27	4	11
5 or more . ..	1939	45	45	—	—
	1940	42	46	4	4
	1941	41	46	5	9
	1942	39	47	8	17
	1943	37	48	11	28

TABLE XXI

Comparison of Total Maternities at More than 8 Months' Marriage Duration Expected According to 1939 Rates with those Occurring

(thousands)

Year	Expected	Actual	Excess of expected over actual	Cumulative deficit
1939 . ..	546	546	—	—
1940	573	524	49	49
1941	614	518	96	145
1942 . .	623	588	35	180
1943 .. .	623	616	7	187
1944 .	608	669	−61	126
1945 .. .	(600)	588	(12)	(138)

(1) See Note (*n*).

109. It may not, however, be reasonable to suppose that all the 'accumulated deficit' in Table XXI will be made up. It has been repeatedly emphasised in this paper that all the indications are that the reduction in the frequency of high-order births was continuing throughout the war as a continuation of the pre-war trend. The accumulated deficit of fourth and higher-order births amounted (according to Table XX) to 52,000 by the end of 1943. If it is supposed that this deficit will never be 'made up' and that it continued to increase at a rate somewhat below that of 1940–43, it follows that by the end of 1946 there would be an 'accumulated deficit' of say 75,000 maternities which would never be 'made up'.

110. On the other hand it will be remembered that in the years before 1939 legitimate fertility was still declining fairly rapidly—at an average rate of about 1 per cent. per annum. A continuance of this rate of decline in the years 1940–46 would imply that by the end of 1946 there would be an accumulated deficit of 170,000 maternities which would never be made up. It is quite clear that no accumulated deficit of anything like this order of magnitude will remain after the end of 1946. The analysis of expected births thus leads to the important conclusion that the decline in fertility has been far gentler in the war years taken as a whole than in the immediate pre-war years. The significant slackening which occurred in the 1930's in the rate of decline of legitimate fertility has thus continued during the war years.

111. This conclusion may be put in terms of family size. While the frequency of families with four or more children probably continued to decrease during the war years, the frequency of childlessness, and one, two and three-child families can hardly have changed in such a way during the war years as to decrease the average size of family.

112. So far no mention has been made in this section of the effect of the absence of husbands overseas. After 1943 it becomes extremely difficult to make any estimate of the magnitude of this effect. Large numbers of men were coming back to this country in the winter of 1943–44 in preparation for D-Day. Leave for troops in Europe was plentiful after the autumn of 1944. Finally very many men returned to Great Britain between the end of the war and March 1946. If the men returning were eager to have the children which they could not have had when they were away it may be supposed that by the end of 1946 many men who were stationed abroad during the war will have been able to have the children which they would have had if they had remained in this country throughout. However, there must be *some* births which were delayed owing to the separation of husband and wife, and will not be fully 'made up' by the end of 1946. This consideration reinforces the conclusions stated in the last paragraph.

113. Finally this conclusion—that the relative frequency of the different sizes of family with less than four children could hardly have changed in such a way as to reduce the average size of family in the war years—may be reviewed in the light of the detailed analysis of the material up to 1943. It may be recalled that the material provided no evidence that there was either an increase or a decrease in childlessness, though some groups of married women had more first maternities in 1940–43 than would have been expected at pre-war rates (paras. 50 and 72). Such information as was available suggested that the rate at which women were having third births was not decreasing sharply during the war years (para. 100). Thus, so far as it goes, the material provides no evidence that family size has been decreasing during the war years (except for the decline in the frequency of large families).

Note on Analysis of Fertility by Age of Mother

114. Apart from Tables I, XVI and XIX no account has been taken in this paper of the age distribution of married women within each duration group. The reason for this was stated in para. 15. Analysis of fertility rates specific by age and duration of marriage shows that no group of women as defined by age and duration of marriage in 1939, had in 1940–43 more maternities than would have been expected on the basis of the 1939 rates. Thus the 'postponement' hypothesis fully explains all the increases in age-specific fertility rates in 1942 and 1943.

115. All analysis of fertility by age shows (like Tables I, XVI and XIX) that the fertility of older women has been better maintained during the war than that of younger women (cf. paras. 81 and 99).

SUMMARY OF CONCLUSIONS

I. Special Features of the Years under Consideration

(*a*) The rush of marriages of young women affects the validity of comparisons between the age-specific fertility rates of 1939 and of 1940–43.

(*b*) Both the declines in fertility in 1940–41 and the increases in 1942–43 were mainly due to changes in the number of first, second and third births. The totals of high-order births decreased. Analysis of births by parity was therefore necessary at all stages.

II. Maternity Rates by Duration of Marriage

(*a*) The 1939 fertility rates by duration may reasonably be used for the purposes of this analysis as a measure of the general level of fertility that would have obtained had there been no war.

(*b*) The course of the fertility rates by duration is in agreement with the hypothesis that many married couples decided to have in 1942 and 1943 children which they would have had in 1940 and 1941 if, in those years, married couples at each marriage duration had maintained the 1939 fertility rates for the corresponding marriage durations.

(*c*) This postponement hypothesis fully explains the high level of fertility rates in 1942 and 1943.

III. Maternity Rates by Duration of Marriage and Order of Birth

If the rates examined in Section II are split into separate components for births of each parity it appears that:

(*a*) The elimination of large families, illustrated by the decline in high-order birth rates, has gone on throughout the war years, in smooth continuation of the process traceable in the pre-war figures for 1938 and 1939.

(*b*) In the case of first, second and third births the war resulted in sudden changes which do not appear as a continuation of pre-war developments.

(*c*) The figures examined support the hypothesis that a 'making up' of postponed births took place in 1942 and 1943.

(*d*) The 'postponement' hypothesis cannot fully explain the rises in first-maternity rates in 1942 and 1943.

IV. Average Marriage Duration at Maternity

Calculations of the average marriage duration at which births of different parities occurred in successive years provide a measure of the average period of time by which births were postponed. They show that the effect of 'postponement' on the duration at which births of low parity occurred was much more marked than in the case of high-order births.

V. Family Size

(*a*) The size of family attained by the end of 1943 by women married eight years or less at that date was very small.

(*b*) Consideration of the size of family attained by groups of women married in successive periods shows that there is no evidence of a long term trend towards an increase or decrease in childlessness. The attainment of a family of two or more children in the first few years of marriage became rarer as successive generations of married women followed one another.

V. " True " Birth-Order Rates

(*a*) The first-maternity rate relating to marriage duration ' 9–11 months ' was higher during the war in relation to the pre-war level among older than among younger married women.

(*b*) " True " birth-order rates relating to births of various parities were estimated by two different methods for groups of married women defined by duration of marriage and age respectively. Comparison shows that the rates obtained by the two methods agree in all the main features.

(*c*) Examination of true-birth order rates supports the ' postponement ' hypothesis.

(*d*) The " true " birth-order rates for third and fourth births show no increases in recent years, but have probably only been declining slowly in the case of the age groups which are responsible for most third and fourth births.

VIII. Expected Legitimate Maternities

Calculations of ' expected ' births for 1940–45

(*a*) confirm the postponement hypothesis.

(*b*) show that the average size of family has been falling more slowly than in the years immediately before the war.

NOTES

(*a*) *Paragraph 7*

An age distribution for the wives of husbands abroad was obtained as follows: The number of married men in each age group in 1941 was estimated by adding the marriages in the years before 1941 at appropriate ages. Allowance for the dissolution of marriages before 1941 was made by reducing these figures in the ratio which the Registrar General's estimates of the married men in each age group in 1939 bore to the original numbers of marriages of which these married men were survivors. The number of married men in 1941 was then divided by the total number of males in each age group in 1941 and the resulting marriage proportions applied to men in the Services. (An age distribution of men in the Services in 1941 was supplied by the Central Statistical Office.)

The number of married servicemen in each age group thus estimated was reduced in the ratio of the average number of married men abroad between March, 1941, and March, 1942 (obtained as indicated in the text) to the total of married servicemen. The age distribution of the wives was derived from the age distribution of the husbands by allocating to each age group of husbands wives of different ages in accordance with the proportionate age distribution (as found in the 1931 census), of wives to husbands of that age.

From these figures of wives " sterilised " was derived the proportion of all married women " sterilised " in the period relevant to the births of 1942. The total legitimate maternities to each age group of women were then divided by (1 − the proportion of sterilised wives in the age group). The sum of the figures thus obtained is the number of maternities that would have occurred in 1942 if the wives " sterilised " had had children at the same rate as those whose husbands were available.

(*b*) *Table I*

The populations were taken as the sum of the marriages at the same ages as the maternities in the first half of the year in which the maternities occurred, plus the marriages contracted by women one year younger than the ages at maternity in the last six months of the previous year. As the marriages by half years were only available in quinquennial age groups the numbers of women marrying at the appropriate ages throughout the year were reduced by the proportion of total marriages in the second half of the year to those in the whole year. This method was chosen as most maternities due to ante-nuptial conceptions occur in about the sixth month of marriage. The first maternities " for which a detailed analysis of marriage duration by months has been available in Table RR of the *Registrar General's Statistical Review*(1) are first maternities by all husbands of the mother (though this was not expressly stated in the *Review*). For 1943 the full analysis was available for all maternities which were first maternities by the present husband of the mother. The exclusion from the analysis of ante-nuptial conceptions of those cases in which the mother happens to have had a child by a previous marriage does not seem justified for the purposes of this study. Moreover, as the rates of ante-nuptial conceptions are used below in conjunction with the Registrar General's estimates of the population of married women by duration of present marriage (and no separate identification of women married more than once is possible) it has been thought better to make an adjustment to allow for the first maternities of women who have had a child by a previous marriage. The first maternities in the first year of marriage by the present husband are given in Table SS. The number of maternities at less than 8 months' marriage duration in each age group (according to Table RR) was therefore multiplied by the ratio of total first maternities by the present husband (SS) in the first year of marriage at that age to the total first maternities by all husbands (RR) in the first year of marriage at that age.

This adjustment was, of course, unnecessary in the case of the 1943 figures. For all years the maternities were multiplied by an allowance for "not stateds".

The rates for 1939 and 1940 were also adjusted by the ratio of the total legitimate maternities occurring to the total legitimate maternities registered in those years.

It will be noticed that in spite of the disturbances during the war years the rates give a smooth run. The adjustment for the first maternities of women with children by previous husbands places the 1939 rates roughly in line with those for 1943 at the higher age groups (the fact that at the younger ages the 1943 rates were below those of 1939 is commented on in the text).

For comparison, rates of first maternities by *all* husbands for 1939 (identical with those in Table I, except for the adjustment just mentioned) are given below, together with the rates calculated by the Registrar General on the basis of the registration data of July–December 1938.

(1) Where tables are quoted below without indication of source, the reference is always to the published tables (Part II Civil) of the Statistical Review for the year mentioned

First Maternities by all Husbands in the First 9 Months of Marriage per 1,000 Relevant Marriages

Age at maternity	Year of maternity	
	1938[1]	1939
Under 20	417	505
20–24 .	186	195
25–29	97	96
30–34 .	80	81
35–39 . .	55	56
40–44	—	20

The close agreement of the 1939 figures with the rates calculated by the Registrar General[2] is encouraging, as the latter figures were based on population estimates computed by a different method. As marriages were fluctuating much less sharply before the war than in later years, more reliance can be placed on the rates for 1938 and 1939.

It should be noted, however, that all the rates of ante-nuptial conceptions given are probably too low. The process of rateably redistributing the cases where marriage duration is not stated probably leads to an underestimate of the number of ante-nuptially conceived maternities. For the proportion who do not state marriage duration is far higher among those who state that they have not had a previous child, than among those who state that they have already had one child. The proportion where marriage duration is not stated is higher again in the case of the higher-order births than for second births. The excessive proportion of " not stated marriage duration " among first births is perhaps mainly due to a desire not to reveal ante-nuptial conceptions. If it be assumed that in 1939 the proportion of first maternities of which the marriage duration had not been stated was the same as for second maternities except for ante-nuptial conceptions the number of ante-nuptial conceptions in 1939 (and, therefore, the rates in Table I) should be raised by 1·2 per cent. The true underestimate of ante-nuptial conceptions is, however, larger, as among those maternities in which neither birth order nor duration of marriage were stated the number ante-nuptially conceived was probably larger than that

(1) From the *Registrar General's Statistical Review, 1938, Tables, Part II, Civil,* p. 146.

(2) The agreement is not close in the case of the rate for ages below 20. It is, however, probable that the Registrar General's Report underestimates this rate. The population at risk is there taken as " half-total women of appropriate age who married in 1938 ". Most of the ante-nuptial conceptions registered in the last 6 months of 1938 must have occurred to women married at the end of 1937 and the beginning of 1938. Most women having ante-nuptial conceptions under 20 marry at ages below 19. The marriages of women at these ages in 1937 and 1938 were as follows:

Age	1937	1938
16	1,236	1,274
17	4,965	5,122
18	9,834	14,593

The striking increase in marriages at age 18 was due largely to the fact that the survivors of the 960,000 births of 1920 were succeeding the survivors of the 690,000 births of 1919. As the chance of marriage is far greater for a woman at the end than at the beginning of the nineteenth year of life, most of the 14,593 marriages must have taken place in the latter half of 1938. Thus an overestimate of the population at risk is involved in the method used in the *Statistical Review.* The correct rate for the ante-nuptially conceived maternities of mothers under 20 in was probably nearer 0·5 than 0 4.

obtained by " rateable distribution ". Moreover, some deliberately inaccurate statements are probably made at registration to conceal the fact that a maternity is due to ante-nuptial conception.

In the years after 1939 the proportion of maternities for which marriage duration is not stated decreases slightly. The 1943 figures present a curiously different picture, as the " excess " in the proportion " not stated " among first maternities has disappeared in the case of the older mothers. It is still marked at the ages where ante-nuptial conceptions are most frequent.

(c) *Table II*

For 1939 and 1940 the figures were obtained by distributing the total legitimate maternities occurring in these years (from Table EE for 1940) among the births of each order (as given in the first line of Table MM for 1939 and 1940). For 1941–1943 the statistics were based on the maternities occurring. From Table SS of 1941–1943 were derived the total number of maternities for which the number of previous children had been stated, and the " not stateds " were rateably distributed(1).

(d) *Table III*

Legitimate maternities of women aged 15–45 from Tables OO (adjusted for " not stateds " and, in the case of 1939 and 1940, the ratio of occurrences to registrations) per 1,000 married women aged 15–45 of appropriate marriage durations.

(e) *Paragraph* 26

The method described in the text would not be entirely accurate even if the maternity rates used were subject to no error. The births to which the rates summed in any one column of Table IV relate do not represent all the births of any one group of women. To consider the example given in the text, it is possible for a woman to have a birth at marriage duration ' 5 ' in 1940 and another at marriage duration ' 7 ' in 1941. This would be the case, for example, if a woman who had married in July 1934, had a maternity in March 1940 (i.e. at marriage duration ' 5 ') and another in September 1941 (at marriage duration ' 7 '). In the process of computation resulting in Table IV, the maternity of 1941 would be allocated to a different group of women from that to which the maternity of 1940 is allocated.

(f) *Paragraph* 32

It was assumed that women at different marriage durations would have to be separated from their husbands to varying degrees as some duration groups contain far more young women than others. Thus the proportion of women " sterilised " applied to the maternities of duration group ' 4 ' in 1943 is an average of the proportions " sterilised " in 1943 in each age group of married

(1) A minor point may be worthy of mention. The proportion of maternities for which marriage duration is not stated is particularly high among first births as mentioned above. A very slightly different result is therefore obtained if the total legitimate maternities are distributed between the birth orders in the proportions indicated by the cases where both birth order and interval since marriage have been stated (i.e. the totals in the first line of Table SS). The proportion of cases where the mother's age is not stated also varies with birth order (being very much lower in the case of first births than higher-order births). This point is of some slight importance as it is tempting to adjust the figures given in Table II in accordance with the distribution of the maternity occurrences in 1939 and 1940 by age of mohter, which is known to have been different from the distribution of the registrations by age of mother (cf. Table EE, 1940, with Tables AA 1939 and 1940) These and similar problems however, usually make too small a difference to be worthy of notice, as various experiments have shown. No further discussion of such points has been included in subsequent notes.

women (obtained as described in Note (*a*)). The proportions were weighted in accordance with the distribution by age of mother of the maternities in Table SS to women at marriage duration '4'. Proportions of women "sterilised" thus computed for each duration for 1942 and 1943 were then used to reduce the number of maternities 'expected' on the basis of the 1939 fertility rates. The sums of the maternity rates in section (*a*) of Table IV were then divided by these reduced figures to give the figures in paragraph 32.

(*g*) *Table V*

Rates in Table III separated into parity components in the proportions in which the maternities on which each rate was based were divided among the different parities according to Table SS.

(*h*) *Paragraph* 51

These figures were computed in a way similar to that described in Note (*f*). For each duration group a special proportion of women "sterilised" was calculated by taking a weighted average of the proportions "sterilised" by age group (Note (*a*)). The weights were the second maternities to each age group at the duration in question (Table SS).

(*i*) *Table VIII*

First maternities at duration '0–8 months' were excluded in accordance with Table RR.—The calculation of the "total marriage duration" of women at maternity necessitated assumptions about the average duration of marriage of the women in each duration group. The assumptions made are those suggested in the *Registrar General's Statistical Review 1938, Tables, Part II, Civil*, p. 141. Accordingly the average duration at maternity of women at duration '1' was taken as $1\frac{1}{2}\frac{1}{4}$ years, the average for duration '2' as $2\frac{1}{2}\frac{1}{4}$ etc. For the groups 10–14, 15–19 etc., the mean duration was taken as 11·5 years, 16·5 years etc. First maternities in the first two years of marriage were treated separately by three-monthly intervals since marriage (as in Table QQ).

(*j*) *Table XII*

The rates used for standardising the figures are those of Table V except in the case of figures relating to first maternities excluding those ante-nuptially conceived. In this case rates relating to maternities in the last 3 months of the first year of marriage (see Table XVI) were used instead of the rate given in Table V for duration '0'. The average durations applied to the rates were those referred to in Note (*i*) except that for the rate relating to duration '10 and over' a separate mean duration was calculated for each year on the basis of the distribution by duration (given in Table SS) of the maternities at duration '10 and over' occurring in the year in question. For second maternities the experiment was made of standardising the mean durations for 1939 and 1943 by age as well as duration of marriage. The resulting figures were 5·43 and 6·38 in place of 5·49 and 6·36 respectively. These discrepancies are due to the fact that the standard population used was more heavily weighted with women at the younger age groups than the actual population of 1939, but less heavily than the population of 1943. As younger women bear children more rapidly than older women, standardising for age as well as duration decreases the average duration of marriage at maternity for 1939 but increases it for 1943. Standardisation by duration only is preferred in the text because of the effect of the "anticipated" marriages in the early war years on the comparability of age-specific fertility rates (see para. 15). In any case the difference made by standardisation by age is small, whereas the process of computation takes many times as long as when marriage duration alone is taken into account.

(*k*) *Table XIII*

The process, described in the text (para. 67) of " subtracting the total number of second maternities to a group of women before a given date from the total number of first maternities by that date " overestimates the number who have borne one child and one child only. If a woman has twins at her first maternity, she has after that two children, and her next maternity will occur after " 2 " previous children. To obtain the number of women with one child and one child only, women with twin first maternities have to be subtracted from those who have had a first maternity to make the process described yield the correct result. The difficulty arises because the parity of maternities (not births) is stated, in the material available since 1938, in terms of " previous children " (not previous maternities).

The following procedure was therefore adopted. The number of women who have had twins at their first maternity was obtained by multiplying the first maternity rates by the proportion of twin maternities among first legitimate maternities. This proportion was calculated from Table II for 1938. The 1938 proportions were used for all parities. In fact the proportions of multiple maternities have remained constant for practical purposes from year to year.

The process of computation by which Table XIII was obtained may now be illustrated by an example. The number of women (per 1,000) who have borne two live or still-born children and two only by the end of 1943 when they had completed marriage duration ' 4 ' is given by:

(the number of women who by the end of 1942 at marriage duration ' 3 ' had had two children and two only)
\+ (the number who at marriage duration ' 4 ' in 1943 had twins at their first maternity)
\+ (the number who had a maternity after " 1 previous child " at marriage duration ' 4 ' in 1943)
— (those among this last group who had twins)
— (the number who had a maternity after " 2 previous children " at marriage duration ' 4 ' in 1943).

The fertility rates assumed for 1937 (referred to in para. 68) were the same as those for 1938, as the general legitimate fertility rate (the number of legitimate births per 1,000 married women under 45) was the same in 1937 as in 1938. The rates assumed for 1936 were obtained by multiplying 1938 rates for the required duration and parity by the ratio of the general legitimate fertility rate of 1936 to that of 1938.

(*l*) *Table XVI*

The populations to which the maternities occurring at marriage duration 9–11 months should be related can be estimated only approximately. For example the number of marriages to which the maternities occurring in 1940 to women aged 20–24 at marriage duration 9–11 months should be related was thought to be roughly given by:

½ the marriages at ages 20–24 in January–March, 1940.
\+ all the marriages at ages 19–23 in April–December, 1939.
\+ ½ the marriages at ages 19–23 in January–March, 1939.

These totals could, however, be obtained only approximately as the age distribution of marriages by quarters is not available and the age distribution of marriages by half years only in the customary quinquennial groups. For the marriages in the first quarter of 1940 the age distribution of the whole of the first half of 1940 was assumed to apply. The marriages in 1939 were estimated from the age distribution of all marriages in that year.

The populations for other age groups and other years were estimated similarly.

The maternities related to these populations were those given in Table QQ as occurring at marriage duration '9–11 months'. These were adjusted for "not stateds", the difference between occurrences and registrations, and the difference between maternities which are the woman's first maternity by the *present* husband and those which are the first by *any* husband (by the method described in Note (*b*)).

The rates obtained by dividing these totals of maternities by the populations described are as follows (no allowance being made at this stage for the number of women who could not have a maternity 9–11 months after marriage because they had had one in the first 9 months of marriage):

Post-nuptially Conceived Maternities in First Year of Marriage per 100 Brides, not Excluding Pregnant Brides from Populations

Age group	1939	1940	1941	1942	1943
16–19	100	95	94	95	110
20–24	102	97	82	95	100
25–29	92	86	75	86	95
30–34	90	87	78	86	93
35–39	64	60	61	62	68
40–44	24	23	21	20	24

If these rates are calculated without the adjustment for the difference between the first maternities by present husband and those by all husbands, the 1939 values are in good agreement with corresponding values in the *Statistical Review* for 1938, except at ages under 20 (in the same way as was found in the case of the rates for ante-nuptially conceived maternities in Note (*b*)).

The figures in Table XVI were obtained from the table just given by excluding the brides pregnant at marriage. This was done by dividing each rate in the table above by (1 – the rate for the corresponding age group and year in Table I). This method is not strictly speaking correct, as the marriages to which the rates in Table I refer are not quite the same as those to which the above figures relate. For example the women who had maternities at ages 20–24 at less than 9 months' marriage duration in 1939 were married at a slightly later age on the average, and at a slightly later time, than the women who had had maternities in 1939 at the same age, but at marriage duration '9–11 months'. The method of computation used implies that a figure for the proportion of brides pregnant at marriage based on the former group of women is applicable to the latter. The error cannot, however, be considerable. It is largest for the age group 16–19.

(*m*) *Table XIX*

As the number of widows awarded pensions in a year forms only a small sample of the total population of married women the following table gives the standard errors of the proportions of widows with various numbers of children. It was thought sufficient to calculate one standard error for each set of proportions relating to a single age group and a given number of children. The proportions for 1939 were used. The size of the sample was taken as the average number of widows in the age group in question awarded pensions in 1939–1943. (The number of widows in each age group was fairly constant from year to year.) The standard errors are given as percentages of the proportions to which they relate.

Standard Error (per cent.) of Proportions of Widows with Various Numbers of Children

Age group	Number of children				
	0	1	2	3	4
20–24	3·6	4·0	8·9	—	—
25–29	3·2	2·9	4·5	7·7	—
30–35	3 2	2 6	3·4	5·1	7·7

Fluctuations of random sampling in the proportions of widows with various numbers of children may thus result in errors in the rates for the higher parities in Table XIX even though they have been rounded to a considerable extent.

Whether widows awarded pensions are a random sample, with respect to family size, of the population at large, is, of course, another question. On this question, there is very little evidence. The proportions "childless" obtained from the figures for widows may be checked by comparison with the proportions of women dying childless derived from the fertility data now obtained at death registration. The following table shows that the two series of figures agree quite well at ages under 35. As the pension statistics only relate to children eligible for allowances, and most children cease to be eligible at 14, it is to be expected that the proportions childless should be overstated at the high ages. A widow whose youngest child was over 14 would often be counted as childless. For this reason Table XIX is restricted to the age range 20–34.

Proportions Childless among (A) Widows awarded Pensions, (B) Married Women dying, 1939–1942

Year	Source	Age Group			
		20–24	25–29	30–34	35–39
1939	(A)	·384	·328	·228	·268
	(B)	·384	·304	·257	·206
1940	(A)	·439	·322	·241	·282
	(B)	·437	·348	·236	·214
1941	(A)	·469	·345	·264	·290
	(B)	·466	·336	·256	·204
1942	(A)	·498	·305	·255	·293
	(B)	·483	·356	·254	·223
1943	(A)	·450	·310	·249	·290
	(B)	·473	·345	·274	·221

There are several reasons why it is not strictly correct to relate the maternity figures to populations based on the pension figures in the way that has been done.

(1) The maternities are tabulated in age ranges of 20–24, 25–29, etc., the classification of ages being on the basis of "age last birthday". For the pensions figures the age groups are 21–25, 26–30, 31–35, the age stated being the "nearest age of widow at award".

(2) The maternities are the totals for England and Wales as a whole, the pension figures relate to England only.

(3) The size of family in the pension figures is stated in terms of dependent children eligible for allowances (i.e. surviving children under working age); the maternities relate to the total children (live or still born) by the present husband.

(*n*) *Table XX*

The several components of the total of "expected" maternities may be dealt with in turn.

(1) The numbers of maternities of different parities "expected" at marriage durations '1' to '8' were first calculated by applying the 1939 rates given in Table V to the married population of 1940–1943. For certain durations, however, the first-maternity rates of Table V were not used (see (4) below).

(2) The 1939 rates by age and parity for women married over 9 years were then applied to the population of appropriate ages and durations of marriage. The rates used were the result of dividing the numbers of maternities of different parities to each age group at duration "9 and over" (obtained from Table SS) by the number of married women of that age who had been married 9 years or more.

(3) The number of women (of all ages) at risk of having a maternity at marriage duration 9–11 months in each year was obtained by adding the estimates of married women on which Table XVI was based (cf. note (*l*)) for all age groups. From these figures were subtracted the totals of ante-nuptially conceived maternities occurring in the year. The totals for all ages of the maternities at duration '0–8 months' from Table QQ, were adjusted as described in Note (*b*). This procedure is not quite correct since, as was pointed out in Note (*l*), the women "at risk" of having maternities at duration 0–8 months in a given year are not entirely identical with the women "at risk" of having maternities at duration 9–11 months in the same year.

This subtraction excluded from the population of women "at risk" of having a maternity at duration '9–11 months' those who had already had a maternity. The populations obtained were multiplied by the 1939 maternity rate at marriage duration '9–11 months' to women not pregnant at marriage (a rate for women of all ages similar to the rates in Table XVI). This gave the maternities expected in each year at duration 9–11 months according to the 1939 rates.

(4) For certain groups of women married during the war, the 1939 first maternity rates were specially adjusted to allow for the fact that fewer of the women had been pregnant at marriage than was normal before the war; as is explained in para. 103. This may be illustrated by means of the group of women who were at marriage duration '1' in 1941, '2' in 1942, etc. They were at marriage duration '0' in 1940 and it was assumed that the proportion pregnant among them was the same as the proportion pregnant among women marrying between July, 1939, and June, 1940 (it was in this period that the bulk of the marriages of those who were at marriage duration '0' took place). The rate at which the women married between July, 1939, and June, 1940, had ante-nuptially conceived maternities had been calculated when maternities at duration 0–8 months were studied (see Note (*b*)). By subtracting this rate from 1 the proportion of the women not pregnant at marriage was derived. This proportion was divided by the corresponding proportions for marriages taking place between July, 1938, and June, 1939. The 1939 first-maternity rate at

marriage duration '1' was raised in this ratio and then applied to the 1941 population of married women at duration '1'. The 1939 rate at duration '2' was raised by the same factor and applied to the population of married women at duration '2' in 1942.

A similar factor (proportion not pregnant at marriage divided by the pre-war proportion) was computed for the group of women at duration '1' in 1942 and '2' in 1943, etc., and the group at duration '1' in 1943 etc., and the 1939 first maternity rates were raised by the appropriate factor before being applied to obtain the first births "expected" at pre-war rates from the women married during the war.

(5) As there are in every year a certain number (between 1,000 and 1,500) of second and even third and fourth maternities at duration '0' (see footnote to Table V), the 1939 rates for these maternities were applied to the populations at marriage duration '0' as estimated by the General Register Office.

As a check, the processes described were applied to the 1939 populations and duly gave the correct totals for the maternities of each parity in 1939.

Rates obtained by relating the deaths so tabulated to the population of married persons in each age group are shown in the following table.

TABLE 1

Rates of Dissolution of Marriage per 1,000 Married Men of each Age, 1938–39

Age group	Rate of death of married men	Rate of death of wife	Total rate of dissolution of marriage by death
Under 20	(·77)(1)	(1·33)(1)	(2·10)(1)
20–24	1·24	2·15	3·39
25–29	1 66	2 23	3 89
30–34	2·06	2·28	4·34
35–39	3 03	2·73	5·76
40–44	4·60	3·57	8·17
45–49	7·04	4 93	11·97
50–54	11·56	7 33	18 89
55–59	17 68	10 46	28 14
60–64	27·67	16 68	44·35
65–69	41·68	24·93	66·61
70–74	66 54	37 26	103·80
75–79 . . .	122·10	64·51	186·61
80–84	176·11	86·33	262·44
85 and over	254·49	101·09	355·58

Rates of Dissolution of Marriage per 1,000 Married Women of each Age, 1938–39

Age group	Rate of death of husband	Rate of death of married women	Total rate of dissolution of marriage by death
Under 20	(1·19)(1)	(2 50)(1)	(3·69)(1)
20–24	1·46	2·17	3 63
25–29	1·80	2 23	4·03
30–34	2·49	2·40	4 89
35–39	3·97	2·95	6·92
40–44	6·23	3·80	10·03
45–49	9·81	5·42	15 23
50–54	15·45	8·05	23·50
55–59	22·44	11·58	34 02
60–64	35·16	19·12	54 28
65–69	50·01	29·66	79·67
70–74	72·73	47·67	120·40
75–79	113·78	82·83	196·61
80–84	154·16	123 36	277·52
85 and over	187·65	181·56	369·21

(1) The numbers of deaths in these age groups were very small.

The figures show the features that would be expected in this type of data. The rate of dissolution of marriages in which the husband is of a certain age is lower than the rate for marriages in which the wife is of the same age, because husbands are on average older than their wives. The chance that a marriage be dissolved by the death of the husband is greater than the chance of dissolution by the death of wife in most age groups both because husbands are usually older than their wives and because the mortality of men is heavier than the mortality of women. Exceptions occur at the young ages, because owing to the high fertility of very young married women, their mortality is high. This is in accordance with experience in other countries (1).

(1) Cf. e.g. P. Depoid, "Mortalité par état matrimonial, dissolution des unions suivant la durée et l'âge combiné des deux époux", *Journal de la Société de Statistique de Paris*, 1938, p. 77.

Computation of Probabilities of Dissolution

The probability that a marriage in which the wife was aged exactly x would be dissolved within one year either by her own death or by that of her husband (denoted by q'_x) was derived mainly by the method used in the official English life tables. For each quinquennial age group, all the dissolutions occurring in 1938 and 1939 were added together and the numbers of women in mid-1938 and mid-1939 were also added together. Quinquennial pivotal values were found and from these the probability of dissolution within a year was computed for marriages in which the wife was aged 22, 27 . . . 77. It was assumed that the central rate of dissolution as given in Table 1 above (·00369) for the age group 16–19 was sufficiently near q'_{17} and thus another pivotal value was available. By osculatory interpolation values of x were found for all ages from 22 to 72. For ages over 72 the following formula was used (q'_{77} having already been computed).

$$\log p'_{(72+x)} = \log p'_{72} \times r^x$$

$$\text{where } r = \frac{\log p'_{77}}{\log p'_{72}}$$

The rates thus obtained related to marriages at which the wife had just reached her xth birthday. It is, however, more useful to have rates applicable to marriages in which the wife is aged between x and $x + 1$ (i.e. x last birthday). Let the probability that such a marriage be dissolved within one year be denoted by $\bar{q}_x$ It was then assumed that $q_x = \frac{1}{2}(q'_x + q'_{(x+1)})$.

For ages under 22 it was assumed that $\bar{q}_x$ is constant at ·00360. In fact it should probably decrease slightly over this range since the decline with increasing age in the death rates of married women probably outweighed the increase with age in the mortality of their husbands. But not enough information is available to fix on any definite values.

Exactly the same procedure was adopted for computing the probability of dissolution for marriages grouped by the age of the husband.

The values of $\bar{q}_x$ and corresponding values of $\bar{p}_x$ are given in Tables 4*a* and 4*b*.

These values of $\bar{q}_x$ are based on dissolutions of marriages of all durations and are specific by the age of wife (or husband) only. If we neglect the influence of marriage duration we can obtain from the values of $\bar{p}_x$ the proportion of survivors after a given period out of an original cohort of marriages of given age of wife (or husband). For example the probability that a marriage in which the wife is aged 22 (at last birthday) will not be dissolved in the first 3 years of its existence is ($\bar{p}_{22} \times \bar{p}_{23} \times \bar{p}_{24}$).

To facilitate this sort of computation, Table 4 also gives the " surviving marriage " to various ages of the wife or husband out of 100,000 marriages contracted by persons aged 16 at last birthday ($\bar{l}_x$). With the help of these figures the probability that a marriage in which one partner is aged a survive b years may be simply computed as

$$\bar{l}_{a+b} \div \bar{l}_a$$

Survivorship Table for Marriages of Persons of all Ages

To obtain a general table relating to marriages of persons of all ages it is necessary to assume a distribution of marriages by age. The distribution used is that of the marriages of a generation of women subject throughout their lives to 1938 nuptiality and 1938–39 mortality. Remarriages have been included. The distribution is given in Table A in the appendix.

It was assumed that the marriages in the age group 16–19 could be treated as occurring to women aged 18 (last birthday); marriages in other age groups were regarded as occurring at the central age of the 5-year period, i.e., 22, 27, etc.

By applying the appropriate values of $\bar{p}_x$ specific by age of wife to the distribution of marriages by age, the table reproduced in Table 5 was obtained.

II : Dissolution by Divorce

For England and Wales, divorce statistics of demographic interest are extremely scanty. For the country as a whole only the total number of divorces and decrees of nullity every year is known. Some small information is available about duration of marriage and the number of children of couples in respect of whom petitions for divorce or annulment are filed at the Divorce Registry in London (1).

It is thus possible to make only rough calculations of the frequency of divorce. Moreover, in 1937 the Matrimonial Causes Act materially changed the legal position in regard to divorce, and the statistics of 1938 and 1939 may not yet fully reflect the results. During and after the war the number of divorces per annum has increased extremely rapidly and in 1946 and 1947 the number of petitions for divorces has been at more than 5 times the pre-war level. The situation has thus been so fluid that, even if proper divorce statistics were available, the results of analysing them in detail would not be very useful. Accordingly only a few very tentative calculations, relating to the frequency of divorce just before the war, are presented below.

The only statistics useful for the present purpose are those giving the distribution of petitions for divorces filed in London by certain broad groups of duration of marriage. For want of better information, the total number of divorces and annulments in 1939 were distributed by duration of marriage in the same proportion as petitions filed in London in 1938 and 1939 (2). The number of marriages of various durations existing in 1939 is not known. However, since it is known in what period the marriages dissolved in 1939 after a certain duration must have been contracted, the numbers of marriages dissolved were related to the total number of marriages occurring in that period. The details of the computation may be seen in Appendix Table B.

We may suppose that a generation of marriages is throughout their existence subject to the rates of divorce described above. Then, as may be seen in Table 2 below, 2·6 per cent. of them would be dissolved by divorce.

TABLE 2

Divorce Rates, 1939

Duration of marriage (completed years)	Yearly rate of divorce per 10,000 original marriages	Number of marriages divorced in period out of original cohort of 10,000(3)
0	1	1
1	1	1
2–4	6	18
5–9	14	70
10–19	11	110
20–29	6	60
Total		260

(1) The figures are published annually in *The Registrar General's Statistical Review, Tables, Part II,* Civil, Table P.

(2) It should be noted that by this procedure divorces are implicitly classified by the period after marriage at which the petition was filed. The resulting divorce rates are therefore really the rates at which persons married a given time file such petitions for divorce or annulment as will succeed.

(3) Figures in previous column multiplied by number of years in period, e.g., 6 × 3 = 18, etc.).

The number of divorces given in Table 2 is not precisely that which would be experienced by a generation of marriages subject to dissolution by death at the mortality of 1938–39 and to the rates of divorce experienced in 1939 by marriages *existing in that year* in England and Wales. For to obtain the figures in Table 2, the divorces in 1939 were related to the number of marriages occurring at various periods in the past, and these marriages had been subject before 1939 to dissolution by a mortality other than that of 1938–39. Their numbers may have been augmented or reduced by migration. But these disturbances could hardly affect the figures in Table 2 appreciably.

By assuming a reasonable distribution of the divorces in Table 2 within each period of marriage duration, it is possible to compute a table of the dissolution of marriages, subject to 1938–39 mortality (as in Table 5) and dissolved by divorce in accordance with the figures already presented. Table 3 below compares the results of such a computation with the table of dissolution taking account of mortality alone.

TABLE 3

Effect of Divorce on Dissolution Rate from all Causes

Period of marriage (completed years)	Assuming no Divorce		Assuming Divorce			Col (2) minus Col. (4)
	Marriages existing at beginning of period	Marriages dissolved during period	Marriages existing at beginning of period	Marriages dissolved by death	Marriages dissolved by divorce	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
0–4 ..	1,000	29	1,000	29	2	—
5–9	971	34	969	34	7	2
10–19 ..	937	96	928	94	11	9
20–29 .	841	159	823	155	6	18
30–39 .	682	238	662	231	—	20
40–49 .	444	264	431	256	—	13
50 and over .	180	180	175	175	—	5
		1,000		974	26	

TABLE 4a

Probability of Dissolution of Marriage by Age of Husband

Age last Birth-day	Probability of dissolution of marriage by death within 1 year	Probability that marriages survive 1 year	Marriages surviving out of 100,000 contracted at 16
x	$\bar{q}_x$	$\bar{p}_x$	$\bar{l}_x$
16	0·00339	0·99661	100,000
17	0·00339	0·99661	99,661
18	0·00339	0·99661	99,323
19	0·00339	0·99661	98,986
20	0·00339	0·99661	98,650
21	0·00339	0·99661	98,316
22	0·00339	0·99661	97,983
23	0·00353	0·99647	97,651
24	0·00364	0·99636	97,306
25	0·00373	0·99627	96,952
26	0·00382	0·99618	96,590
27	0·00390	0·99610	96,221
28	0·00396	0·99604	95,846
29	0·00401	0·99599	95,466
30	0·00408	0·99592	95,083
31	0·00419	0·99581	94,695
32	0·00436	0·99564	94,288
33	0·00459	0·99541	93,877
34	0·00485	0·99515	93,446
35	0·00516	0·99484	92,993
36	0·00550	0·99450	92,513
37	0·00589	0·99411	92,004
38	0·00631	0·99369	91,462
39	0·00677	0·99323	90,885
40	0·00727	0·99273	90,270
41	0·00782	0·99218	89,614
42	0·00841	0·99159	88,913
43	0·00903	0·99097	88,165
44	0·00969	0·99031	87,369
45	0·01044	0·98956	86,522
46	0·01133	0·98867	85,619
47	0·01238	0·98762	84,649
48	0·01358	0·98642	83,601
49	0·01492	0·98508	82,466
50	0·01636	0·98364	81,236
51	0·01789	0·98211	79,907
52	0·01944	0·98056	78,477
53	0·02099	0·97901	76,951
54	0·02261	0·97739	75,336
55	0·02440	0·97560	73,633
56	0·02649	0·97351	71,836
57	0·02896	0·97104	69,933
58	0·03176	0·96824	67,908
59	0·03485	0·96515	65,751
60	0·03818	0·96182	63,460
61	0·04172	0·95828	61,037
62	0·04537	0·95463	58,491
63	0·04910	0·95090	55,837
64	0·05301	0·94699	53,096
65	0·05730	0·94270	50,280
66	0·06217	0·93783	47,399
67	0·06749	0·93251	44,452
68	0·07298	0·92702	41,452
69	0·07890	0·92110	38,427
70	0·08594	0·91406	35,395
71	0·09480	0·90520	32,353
72	0·10593	0·89407	29,286
73	0·11899	0·88101	26,184
74	0·13353	0·86647	23,068
75	0·14970	0·85030	19,988
76	0·16763	0·83237	16,996
77	0·18746	0·81254	14,147
78	0·20932	0·79068	11,495
79	0·23334	0·76666	9,089
80	0·25964	0·74036	6,968
81	0·28831	0·71169	5,159
82	0·31940	0·68060	3,672
83	0·35294	0·64706	2,499
84	0·58890	0·61110	1,617
85	0·42717	0·57283	988
86	0·46757	0·53243	566
87	0·50985	0·49015	301
88	0·55364	0·44636	148
89	0·59847	0·40153	61
90	0·64377	0·35623	24
91	0·68888	0·31112	9
92	0·73304	0·26696	3
93	0·77048	0·22952	1
94	0·81538	0·18462	

TABLE 4b

Probability of Dissolution of Marriage by Age of Wife

Age last Birth-day	Probability of dissolution of marriage by death within 1 year	Probability that marriages survive 1 year	Marriages surviving out of 100,000 contracted at 16	Age last Birth-day	Probability of dissolution of marriage by death within 1 year	Probability that marriages survive 1 year	Marriages surviving out of 100,000 contracted at 16
x	$\bar{q}_x$	$\bar{p}_x$	$\bar{l}_x$	x	$\bar{q}_x$	$\bar{p}_x$	$\bar{l}_x$
16	0·00360	0·99640	100,000	55	0·02958	0·97042	69,166
17	0·00360	0 99640	99,640	56	0·03199	0·96801	67,120
18	0 00360	0 99640	99,281	57	0·03497	0·96503	64,972
19	0 00360	0·99640	98,924	58	0·03850	0·96150	62,700
20	0·00360	0 99640	98,568	59	0·04244	0·95756	60,286
21	0 00360	0·99640	98,213	60	0·04667	0·95333	57,727
22	0·00360	0·99640	97,859	61	0·05102	0·94898	55,033
23	0·00365	0 99635	97,507	62	0·05537	0·94463	52,225
24	0 00372	0 99628	97,151	63	0·05966	0·94034	49,333
25	0·00381	0·99619	96,788	64	0·06408	0·93592	46,390
26	0·00392	0 99608	96,419	65	0·06887	0·93113	43,417
27	0 00405	0·99595	96,041	66	0 07425	0·92575	40,427
28	0 00417	0·99583	95,652	67	0·08020	0·91980	37,425
29	0 00431	0·99569	95,253	68	0·08644	0·01356	34,424
30	0·00448	0·99552	94,842	69	0·09326	0·90674	31,448
31	0 00470	0·99530	94,417	70	0 10088	0·89912	28,515
32	0·00498	0·99502	93,973	71	0·11011	0·88989	25,638
33	0 00532	0·99468	93,505	72	0·12098	0·87902	22,815
34	0 00569	0·99431	93,008	73	0 13317	0·86683	20,055
35	0 00612	0·99388	92,479	74	0·14648	0·85352	17,384
36	0·00660	0·99340	91,913	75	0·16100	0·83900	14,838
37	0·00712	0·99288	91,306	76	0 17680	0·82320	12,449
38	0·00764	0 99236	90,656	77	0·19397	0·80603	10,248
39	0·00821	0·99179	89,963	78	0·21256	0·78744	8,260
40	0·00884	0·99116	89,224	79	0 23267	0 76733	6,504
41	0·00950	0·99050	88,435	80	0·25436	0·74564	4,990
42	0·01035	0·98965	87,595	81	0·27768	0·72232	3,721
43	0 01129	0·98871	86,688	82	0 30221	0·69779	2,688
44	0·01218	0·98782	85,709	83	0·32890	0 67110	1,876
45	0 01324	0 98676	84,665	84	0·35776	0·64224	1,259
46	0·01443	0·98557	83,544	85	0·38782	0·61218	809
47	0·01577	0·98423	82,338	86	0·41948	0·58052	495
48	0·01725	0 98275	81,040	87	0·45266	0·54734	287
49	0·01887	0 98113	79,642	88	0.48722	0·51278	157
50	0·02058	0·97942	78,139	89	0·52298	0·47702	81
51	0·02236	0·97764	76,531	90	0·55969	0·44021	39
52	0·02413	0·97587	74,820	91	0·59208	0.40792	17
53	0·02584	0·97416	73,015	92	0·63481	0·36519	7
54	0·02759	0·97241	71,128	93	0.67251	0·32749	3
				94	0·70975	0·29025	1

TABLE 5

Table of Dissolution of 100,000 Marriages of Women Distributed According to 1938 Nuptiality and 1938–9 Mortality

Completed years after Marriage	Chance that Marriage be dissolved within 1 year	Chance that Marriage survive 1 year	Marriages dissolved within 1 year	Marriages surviving	Mean Expectation of married life
x	q_x^m	p_x^m	d_x^m	l_x^m	$\mathring{e}_x^m$
0	0.00563	0 99437	563	100,000	36 03
1	0.00577	0.99423	574	99,437	35.23
2	0.00594	0.99406	587	98,862	34 43
3	0.00612	0.99388	601	98,276	33 63
4	0 00632	0.99368	617	97,675	32 83
5	0.00656	0.99344	637	97,058	32 04
6	0.00682	0.99318	657	96,421	31 25
7	0.00709	0.99291	679	95,764	30 46
8	0 00740	0 99260	703	95,085	29.68
9	0 00775	0.99225	732	94,382	28.89
10	0.00815	0.99185	763	93,650	28.11
11	0.00859	0.99141	798	92,887	27 34
12	0 00905	0.99095	833	92,089	26.57
13	0.00958	0.99042	875	91,256	25 81
14	0 01015	0.98985	917	90,381	25 06
15	0 01082	0.98918	968	89,464	24.31
16	0 01150	0.98850	1,018	88,496	23.57
17	0.01221	0.98779	1,068	87,478	22 84
18	0.01300	0.98700	1,123	86,410	22.11
19	0.01386	0.98614	1,182	85,287	21.40
20	0.01485	0.98515	1,249	84,105	20 69
21	0 01593	0 98407	1,320	82,856	20.00
22	0 01702	0.98298	1,388	81,536	19.31
23	0·01823	0 98177	1,461	80,148	18.64
24	0.01957	0.98043	1,540	78,687	17.97
25	0.02102	0 97898	1,622	77,147	17.32
26	0 02254	0.97746	1,702	75,525	16.68
27	0.02417	0.97583	1,784	73,823	16.06
28	0.02600	0.97400	1,873	72,039	15 44
29	0.02776	0.97224	1,948	70,166	14.84
30	0.02988	0.97012	2,038	68,218	14.25
31	0.03202	0.96798	2,119	66,180	13.68
32	0.03425	0.96575	2,194	64,061	13.11
33	0.03669	0.96331	2,270	61,867	12.56
34	0.03940	0 96060	2,348	59,597	12.02
35	0.04240	0.95760	2,428	57,249	11.49
36	0.04570	0.95430	2,505	54,821	10.98
37	0.04928	0.95072	2,578	52,316	10.48
38	0.05315	0.94685	2,643	49,738	10 00
39	0.05732	0 94268	2,700	47,095	9 53
40	0.06169	0 93831	2,738	44,395	9.08
41	0.06615	0.93385	2,755	41,657	8.64
42	0.07076	0.92924	2,753	38,902	8.22
43	0.07571	0.92429	2,737	36,149	7 81
44	0.08126	0.91874	2,715	33,412	7 40
45	0.08731	0 91269	2,680	30,697	7.01
46	0.09369	0 90631	2,625	28,017	6.64
47	0.10047	0 89953	2,551	25,392	6.27
48	0.10783	0.89217	2,463	22,841	5 92
49	0 11629	0 88371	2,370	20,378	5.57
50	0.12578	0 87422	2,265	18,008	5.24
51	0.13615	0.86385	2,143	15,743	4.92
52	0.14727	0.85273	2,003	13,600	4 62
53	0.15931	0 84069	1,847	11,597	4.33
54	0.17241	0.82759	1,681	9,750	4.05

[*continued overleaf*

TABLE 5—*continued*

Completed years after Marriage	Chance that Marriage be dissolved within 1 year	Chance that Marriage survive 1 year	Marriages dissolved within 1 year	Marriages surviving	Mean Expectation of married life
x	q_x^m	p_x^m	d_x^m	l_x^m	$\mathring{e}_x^m$
55	0.1864	0 8135	1,505	8,069	3.79
56	0.2015	0.7985	1,322	6,564	3.55
57	0 2176	0.7824	1,141	5,242	3.32
58	0.2345	0.7655	961	4,101	3.10
59	0.2526	0.7474	793	3,140	2.90
60	0.2712	0.7288	637	2,347	2.71
61	0.2913	0.7087	498	1,710	2.53
62	0.3124	0.6876	379	1,212	2.36
63	0.335	0.665	278	833	2.21
64	0.357	0.643	198	555	2.06
65	0.380	0.620	136	357	1.9
66	0.404	0.596	89	221	1.8
67	0.429	0.571	57	132	1 7
68	0.46	0.54	34	75	1.6
69	0.48	0.52	20	41	1.5
70	0.50	0.50	10	21	1 4
71			6	11	
72			3	5	
73			1	2	
74			1	1	

APPENDIX

TABLE A(1)

Distribution of Marriages in Stationary Population According to 1938 Nuptiality and 1938–9 Mortality (a Radix of 10,000 female Births is assumed)

Age Group	Spinster Marriages	Subsequent Marriages	All Marriages
15–19	987	—	987
20–24	4,322	13	4,335
25–29	2,020	54	2,074
30–34 .. .	493	87	580
35–39	189	100	289
40–44	83	92	175
45–49	48	85	133
50–54	26	70	96
55–59 . ..	14	51	65
60–64 .. .	8	37	45
65–69 .. .	6	32	38
70–74 . .	1	15	16
75–79 . .	—	5	5
80–84 ..	—	1	1
Total	8,197	642	8,839

(1) From J. Hajnal, "*Births, Marriages and Reproductivity in England and Wales, 1938–47*" (printed elsewhere in this volume), Note II

TABLE B

Calculation of Divorce[1] Rates

Duration of Marriage (in years)	Petitions[2] filed in London 1938–1939	Assumed distribution by marriage duration of all divorces in 1939	Assumed Period of Relevant Marriages	Number of relevant marriages (000's)	Divorce Rate (per 1,000) Column (3) ÷ Column (5)
(1)	(2)	(3)	(4)	(5)	(6)
Under 1	70	38	July, 1938–June, 1939	357.8	0.1
1	58	31	July, 1937–June, 1938	362.6	0.1
2–4	1,125	608	July, 1934–June, 1937	1,053.8	0.6
5–9	3,962	2,143	July, 1929–June, 1934	1,579 4	1.4
10–19	6,438	3,481	July, 1919–June, 1929	3,114.2	1.1
20–29	3,058	1,654	July, 1909–June, 1919	2,886.0	0.6
Total	14,711	7,955			

(1) The figures include both divorces and annulments.

(2) Divorces occurring at marriage durations of " 20 years or upwards" have been related to marriages occurring between 20 and 30 years ago.

SUMMARY OF DEMOGRAPHIC STATISTICS FOR GREAT BRITAIN*

LIST OF TABLES

Table

*Compiled by the Assistant Secretary.

TABLE I

Population of Both Sexes by Quinquennial Age-Groups, 1841–1939

Thousands

Age-group	1841 Census	1851 Census	1861 Census	1871 Census	1881 Census	1891 Census	1901 Census	1911 Census	1921 Census	1931 Census	1939 National Registration
All ages ...	18,534 3	20,816·3	23,128 5	26,072·3	29,710·0	33,028 2	37,000 0	40,831 3	42,769 2	44,795·3	46,568
0– 4 ...	2,449·8	2,719·6	3,118·5	3,526·9	4,031·5	4,055 8	4,249 7	4,387·2	3,794 2	3,413 6	3,279
5– 9 ..	2,219 0	2,432·2	2,707 6	3,111·3	3,597·5	3,872 8	3,980·0	4,210 6	3,996 4	3,778·4	3,222
10–14 ..	2,029·5	2,230·8	2,428 2	2,796 3	3,205 3	3,675·8	3,811·1	3,989 8	4,149 9	3,633·0	3,450
15–19 .	1,857·4	2,057 0	2,240·3	2,516·1	2,925·4	3,369 2	3,702·2	3,799 4	3,981·3	3,873·8	4,067
20–24 ...	1,805·5	1,947·1	2,110·0	2,297·2	2,671·9	3,010 0	3,554·2	3,595 2	3,580·3	3,916 0	3,354
25–29 ..	1,489·2	1,700 8	1,802 2	2,035·4	2,336·5	2,662 9	3,203 5	3,464 8	3,336 7	3,746 2	3,886
30–34	1,355·3	1,469 6	1,589 2	1,780·2	1,982·6	2,297 9	2,746·5	3,232·8	3,138 9	3,404·7	3,862
35–39 ..	1,026·6	1,253 5	1,398 7	1,530·6	1,753 2	2,019 2	2,423·3	2,937·9	3,069·4	3,119 2	3,620
40–44 ...	1,034 2	1,122 2	1,296 7	1,405·5	1,595·7	1,752 2	2,096·1	2,508 4	2,909 6	2,955 8	3,179
45–49 ..	737 2	921·0	1,066·3	1,200·4	1,313·6	1,519 5	1,782 0	2,166·7	2,696·1	2,834·5	2,968
50–54 ..	735·9	827·4	931·0	1,079 4	1,169·5	1,322 7	1,505·5	1,808 4	2,258 8	2,648 2	2,768
55–59 ..	454·9	607·1	708·3	823 2	919·7	1,008 1	1,195 3	1,444 7	1,831 3	2,306 5	2,534
60–64 ..	516·4	559·4	650 3	721 1	833·0	886 4	1,016·3	1,149·6	1,443·4	1,848 7	2,202
65–69 ..	298·8	378·8	434 0	508·7	575·3	651·2	716 5	911·3	1,109 4	1,419·5	1,751
70–74 ...	261·8	291·8	324·9	378·4	405 3	478 6	510·5	634 1	740 3	977 0	1,227
75–79 ...	139 9	169·6	186·7	210 8	234·9	269·1	301·8	352·5	442 4	560 2	713
80–84 ..	84 3	88 3	95·0	105·8	113 9	124·5	148 6	164 6	204 4	252·3	343
85 and over	38·6	40·1	40·5	45·0	45·3	52 3	56 9	73 3	86 4	107 6	144

Sources *England and Wales*, 1841–1931: Census of England and Wales, 1931, General Tables, Table 20, p. 149.
„ 1939: supplied by the Registrar General for England and Wales.
Scotland, 1841: Census of Great Britain (Scotland), pages 140, 141.
„ 1851: Census of Great Britain (Scotland), Part II, p. 1.
„ 1861–1931: Census of Scotland, 1931, Vol. II, Table 33, p. 86.
„ 1939. supplied by the Registrar-General for Scotland.

Notes: 1. The figures for England and Wales, 1841 are approximate.
2. The source figures for Scotland, 1841, contain 4,853 persons not classified by age. These have been rateably distributed. Similarly 2,695 were so distributed for 1861, 379 for 1911, 764 for 1921 and 160 for 1931.
3. The National Registration figures (1939) have been corrected by the Registrars General (*a*) to a quinquennial age-basis, and (*b*) by addition of the estimated numbers of the "excluded classes" (see National Register Report)

TABLE II

Population of Males by Quinquennial Age-Groups, 1841–1939

Thousands

Age-group	1841 Census	1851 Census	1861 Census	1871 Census	1881 Census	1891 Census	1901 Census	1911 Census	1921 Census	1931 Census	1939 National Registration
All ages ...	9,019·5	10,156·7	11,226·1	12,662·1	14,439·4	16,003·1	17,902·4	19,754·4	20,422·9	21,458·5	22,378
0– 4 ...	1,222·7	1,365·8	1,567·3	1,767·3	2,016·1	2,029·8	2,123·7	2,204·3	1,920·1	1,723·8	1,671
5– 9 ...	1,112·3	1,222·3	1,357·6	1,555·4	1,796·4	1,935·1	1,988·3	2,105·2	2,006·8	1,907·3	1,630
10–14 ..	1,031·6	1,126·5	1,225·3	1,410·7	1,608·0	1,840·1	1,909·3	1,994·4	2,083·8	1,835·0	1,735
15–19 ...	910·1	1,019·1	1,108·6	1,252·1	1,457·9	1,676·1	1,837·9	1,888·4	1,966·7	1,928·7	2,033
20–24 ..	837·1	924·1	987·9	1,090·4	1,278·9	1,421·4	1,683·0	1,704·4	1,651·3	1,904·9	1,667
25–29 ..	703·9	803·7	835·7	959·3	1,118·3	1,256·3	1,509·6	1,637·8	1,512·5	1,815·6	1,911
30–34 ..	650·8	706·4	752·5	846·4	952·3	1,106·9	1,308·6	1,546·1	1,436·3	1,595·5	1,891
35–39 ..	500·1	608·5	668·9	725·5	842·9	979·3	1,167·1	1,419·0	1,423·5	1,426·9	1,764
40–44 ..	502·5	545·1	625·0	670·1	763·6	842·9	1,016·2	1,208·2	1,368·9	1,363·8	1,459
45–49 .	359·5	449·4	515·8	574·2	621·1	726·9	860·4	1,041·4	1,304·1	1,316·4	1,362
50–54 ...	352·4	399·7	448·7	516·7	552·3	623·6	719·9	866·5	1,090·4	1,243·0	1,274
55–59 ..	218·5	291·4	342·0	393·4	432·9	468·8	563·1	687·1	878·1	1,103·0	1,166
60–64 ..	242·6	260·6	306·2	337·7	386·0	406·4	466·0	537·1	677·2	869·7	1,018
65–69 ...	138·2	173·7	200·1	234·5	262·8	293·4	319·4	412·0	506·2	646·1	803
70–74 ...	120·3	132·3	146·3	172·7	181·2	210·0	221·8	269·1	315·3	422·5	538
75–79 ..	64·4	74·9	82·5	93·8	103·3	116·0	127·9	143·9	177·9	228·8	288
80–84 ...	36·7	37·4	40·2	44·8	48·2	50·8	59·4	63·8	75·7	93·4	123
85 and over	15·8	15·8	15·5	17·1	17·2	19·3	20·8	25·7	28·1	34·1	44

Sources As for Table I.

Notes: See Notes to Table I. Of the persons in Scotland of age not stated, who have been rateably distributed, the numbers of males were as follows: 1841: 3,191; 1861: 2,467; 1911: 186; 1921: 373; 1931: 90.

TABLE III

Population of Females by Quinquennial Age-Groups, 1841–1939

Thousands

Age-group	1841 Census	1851 Census	1861 Census	1871 Census	1881 Census	1891 Census	1901 Census	1911 Census	1921 Census	1931 Census	1939 National Registration
All ages ..	9,514·8	10,659·6	11,902·4	13,410·2	15,270·6	17,025·1	19,097·6	21,076·9	22,346·3	23,336·8	24,189
0– 4 .	1,227·1	1,353·8	1,551·2	1,759·6	2,015·4	2,026·0	2,126·0	2,182·9	1,874·1	1,689·8	1,607
5– 9	1,106·7	1,209·9	1,350·0	1,555·9	1,801·1	1,937·7	1,991·7	2,105·4	1,989·6	1,871·1	1,592
10–14 ..	997·9	1,104·3	1,202·9	1,385·6	1,597·3	1,835·7	1,901·8	1,995·4	2,066·1	1,798·1	1,715
15–19 ...	947·3	1,037·9	1,131·7	1,264·0	1,467·5	1,693·1	1,864·3	1,911·0	2,014·6	1,945·1	2,034
20–24 ..	968·4	1,023·0	1,122·1	1,206·8	1,393·0	1,588·6	1,871·2	1,890·8	1,929·0	2,011·1	1,687
25–29 .	785·3	897·1	966·5	1,076·1	1,218·2	1,406·6	1,693·9	1,827·0	1,824·2	1,930·6	1,974
30–34 ...	704·5	763·2	836·7	933·8	1,030·3	1,191·0	1,437·9	1,686·7	1,702·6	1,809·2	1,971
35–39 ...	526·5	645·0	729·8	805·1	910·3	1,039·9	1,256·2	1,518·9	1,645·9	1,692·3	1,856
40–44 ...	531·7	577·1	671·7	735·4	832·1	909·3	1,079·9	1,300·2	1,540·7	1,592·0	1,720
45–49 .	377·7	471·6	550·6	626·2	692·5	792·6	921·6	1,125·3	1,392·0	1,518·1	1,606
50–54 .	383·5	427·7	482·3	562·7	617·2	699·1	785·6	941·9	1,168·4	1,405·2	1,494
55–59 ...	236·4	315·7	366·3	429·8	486·8	539·3	632·2	757·6	953·2	1,203·5	1,368
60–64 ..	273·8	298·8	344·1	383·4	447·0	480·0	550·3	612·5	766·2	979·0	1,184
65–69 ...	160·6	205·1	233·9	274·2	312·5	357·8	397·1	499·3	603·2	773·4	948
70–74 .	141·5	159·5	178·6	205·7	224·1	268·6	288·7	365·0	425·0	554·5	689
75–79 ...	75·5	94·7	104·2	117·0	131·6	153·1	173·9	208·6	264·5	331·4	425
80–84 ...	47·6	50·9	54·8	61·0	65·6	73·7	89·2	100·8	128·7	158·9	219
85 and over	22·8	24·3	25·0	27·9	28·1	33·0	36·1	47·6	58·3	73·5	100

Sources. As for Table I.

Notes. See Notes to Table I. Of the persons in Scotland of age not stated, who have been rateably distributed, the numbers of females were as follows: 1841: 1,662; 1861: 228; 1911: 193; 1921: 391; 1931: 70.

Population of Both Sexes by Quinquennial Age-Groups, 1931–1948

Thousands

	1931	1932	1933	1934	1935	1936	1937	1938	1939 A	1939 B	1940	1941	1942	1943	1944	1945	1946	1947	1948
All ages	44,831	45,084	45,265	45,401	45,597	45,805	46,008	46,208	46,467	46,694	46,927	46,908	47,071	47,448	47,659	47,823	47,867	48,221	48,703
0– 4	3,436	3,398	3,349	3,282	3,240	3,202	3,190	3,219	3,263	3,263	3,288	3,262	3,272	3,337	3,436	3,546	3,670	3,971	4,116
5– 9	3,754	3,629	3,541	3,465	3,412	3,369	3,331	3,307	3,228	3,228	3,197	3,166	3,163	3 197	3,240	3,247	3,225	3,238	3,293
10–14	3,661	3,791	3,941	4,069	3,878	3,733	3,611	3,554	3,460	3,459	3,413	3,363	3,327	3,287	3,233	3,192	3,103	3,152	3,183
15–19	3,849	3,743	3,559	3,368	3,496	3,640	3,778	3,932	4,075	4 113	3 904	3,739	3,611	3,524	3,454	3,396	3,401	3,311	3,276
20–24	3,915	3,914	3,900	3,889	3,876	3,808	3,719	3,499	3,387	3,454	3,572	3,671	3,751	3,891	3,980	3,754	3,653	3,531	3,513
25–29	3,765	3,811	3,851	3,883	3,901	3,907	3,903	3,828	3,881	3,920	3,917	3,830	3,712	3,563	3,360	3,449	3,588	3,660	3,826
30–34	3,415	3,511	3,603	3,676	3,728	3,757	3,793	3,793	3,854	3,880	3,908	3,904	3,891	3,895	3,880	3,846	3,781	3,658	3,478
35–39	3,114	3,142	3,167	3,209	3,277	3,363	3 446	3,561	3,597	3,618	3,695	3,722	3,764	3,817	3,846	3,855	3,861	3,845	3,838
40–44	2,966	2,984	2,999	3 006	3,028	3,049	3,074	3,139	3,152	3,165	3,249	3,326	3,415	3,512	3,592	3,643	3,632	3,669	3,713
45–49	2,817	2,826	2,836	2,853	2,869	2,894	2,914	2,950	2 954	2,962	2,994	3,005	3,034	3,067	3,111	3,178	3,238	3,325	3,393
50–54	2,644	2,667	2,682	2,687	2,698	2,707	2,717	2,739	2,759	2,764	2 794	2,809	2,830	2,858	2,872	2,890	2,874	2,895	2,938
55–59	2,301	2,344	2,380	2,417	2,448	2 482	2,503	2,535	2,530	2,534	2,551	2,557	2,573	2,595	2,617	2,639	2,604	2,623	2,650
60–64	1,867	1,910	1,954	1,994	2,041	2,082	2,119	2 174	2,195	2,198	2,227	2,252	2,282	2,304	2,314	2,331	2,310	2,318	2,335
65–69	1,416	1,451	1,490	1,530	1,568	1,612	1,653	1,688	1,739	1,740	1,776	1,798	1,835	1,874	1,904	1,937	1,943	1,969	1,985
70–74	979	1,004	1,030	1,056	1,088	1,119	1,148	1,163	1,221	1,221	1,243	1,271	1,314	1,358	1,392	1,428	1,465	1,489	1,519
75–79	565	583	601	620	637	656	672	681	704	704	723	747	777	815	846	874	890	919	958
80–84	257	263	269	279	293	304	312	320	334	334	336	345	362	384	400	421	438	450	474
85 and over	109	111	113	116	120	121	124	127	134	135	140	145	154	170	185	197	194	199	216

Sources *England and Wales*, 1931–39(A) Registrar General's Statistical Review, 1938–39 Text, p 156
1939(B)–1942 Supplied by the Registrar General
1943–47 Registrar General's Statistical Reviews, Part I, Table 1, p 1
1948 Registrar General's Quarterly Return No 400
Scotland 1931–48 Supplied by the Registrar-General

Notes.—Estimates for the years 1931–38 and 1939(A) exclude armed forces and merchant seamen absent from the country, 1939(B) and later estimates include these groups

TABLE VI

Population of Females by Quinquennial Age-Groups, 1931–1948

Thousands

	1931	1932	1933	1934	1935	1936	1937	1938	1939 A	1939 B	1940	1941	1942	1943	1944	1945	1946	1947	1948
All ages	23,345	23,456	23,542	23,614	23,712	23,822	23,906	24,011	24,134	24,134	24,257	24,275	24,383	24,530	24,652	24,766	24,747	24,884	25,078
0– 4	1,699	1,678	1,652	1,618	1,594	1,575	1,567	1,582	1,601	1,601	1,612	1,598	1,603	1,635	1,682	1,734	1,792	1,937	2,008
5– 9	1,860	1,799	1,756	1,718	1,691	1,669	1,648	1,635	1,596	1,596	1,577	1,560	1,556	1,571	1,592	1,597	1,585	1,591	1,617
10–14	1,811	1,876	1,951	2,017	1,924	1,853	1,794	1,762	1,720	1,720	1,696	1,671	1,651	1,629	1,599	1,576	1,531	1,550	1,565
15–19	1,933	1,874	1,780	1,681	1,741	1,813	1,880	1,947	2,032	2,032	1,942	1,862	1,800	1,757	1,721	1,692	1,682	1,637	1,617
20–24	2,003	1,997	1,987	1,980	1,970	1,933	1,879	1,760	1,700	1,700	1,759	1,821	1,877	1,943	2,002	1,908	1,839	1,760	1,737
25–29	1,936	1,958	1,978	1,992	1,996	1,999	1,991	1,953	1,972	1,972	1,972	1,931	1,873	1,777	1,673	1,722	1,788	1,827	1,897
30–34	1,807	1,830	1,856	1,881	1,904	1,922	1,939	1,945	1,967	1,967	1,978	1,976	1,974	1,965	1,958	1,944	1,908	1,840	1,741
35–39	1,691	1,707	1,720	1,737	1,756	1,781	1,801	1,838	1,844	1,844	1,877	1,893	1,916	1,936	1,951	1,954	1,954	1,941	1,930
40–44	1,598	1,608	1,619	1,627	1,644	1,659	1,674	1,708	1,710	1,710	1,733	1,751	1,775	1,799	1,825	1,849	1,849	1,865	1,880
45–49	1,516	1,523	1,529	1,538	1,547	1,559	1,570	1,598	1,598	1,598	1,617	1,628	1,646	1,662	1,681	1,698	1,724	1,743	1,765
50–54	1,401	1,418	1,431	1,440	1,451	1,459	1,467	1,488	1,489	1,489	1,503	1,511	1,525	1,541	1,554	1,568	1,565	1,577	1,593
55–59	1,206	1,233	1,256	1,280	1,301	1,323	1,339	1,369	1,366	1,366	1,379	1,388	1,400	1,415	1,428	1,439	1,418	1,430	1,448
60–64	988	1,009	1,032	1,054	1,082	1,106	1,130	1,167	1,180	1,180	1,202	1,223	1,246	1,264	1,276	1,290	1,278	1,285	1,296
65–69	772	790	809	830	849	872	894	913	943	943	966	982	1,005	1,031	1,052	1,077	1,081	1,102	1,115
70–74	554	569	583	597	616	633	650	654	690	690	701	713	736	761	781	802	823	842	863
75–79	335	346	357	369	379	392	401	404	421	421	434	447	464	484	501	515	522	539	561
80–84	161	165	169	176	185	192	198	202	213	213	215	221	231	245	253	267	275	283	297
85 and over	74	76	77	79	82	82	84	86	92	92	96	98	105	115	124	132	132	136	148

Sources As for Table IV.
Notes See Table IV

TABLE VII

Population by Age and Marital Condition (Persons), 1851–1947

Thousands

Age group	1851			1861		
	Single	Married	Widowed	Single	Married	Widowed
All ages ...	12,840·1	6,806·8	1,169·4	14,002·6	7,826·2	1,299·8
0– 4 ...	2,719·6	—	—	3,118·5	—	—
5– 9 ...	2,432·2	—	—	2,707·6	—	—
10–14 ..	2,230·8	—	—	2,428·2	—	—
15–19 .	2,026·8	29·9	0·4	2,201·6	38·6	0·4
20–24 .	1,453·4	486·1	7·5	1,529·6	572·7	7·8
25–29 ...	727·2	947·1	26·6	711·9	1,062·9	27·4
30–34	385·2	1,036·7	47·7	377·9	1,163·3	48·0
35–39 .	234·7	955·8	63·0	240·3	1,091·9	66·4
40–44 .	170·3	863·9	88·0	186·4	1,015·8	94·5
45–49 .	120·8	703·2	97·0	130·4	828·5	107·5
50–54 ..	101·3	601·9	124·3	109·5	687·4	134·1
55–59 ..	70·1	419·6	117·4	76·0	497·5	134·9
60–64 ..	64·6	341·9	152·8	72·9	399·4	177·9
65–69 ...	40·6	204·6	133·6	45·6	235·0	153·4
70–74 ..	31·7	128·0	132·1	34·2	141·7	149·0
75–79 ..	17·6	59·3	92·7	18·9	62·8	105·0
80–84 ...	9·1	22·3	57·0	9·4	22·5	63·0
85 and over..	4·2	6·7	29·3	3·9	6·2	30·4

Age group	1871			1881		
	Single	Married	Widowed	Single	Married	Widowed
All ages ...	15,766·7	8,827·2	1,874·4	18,135·4	9,923·3	1,651·4
0– 4 ...	3,526·9	—	—	4,031·5	—	—
5– 9 ...	3,111·3	—	—	3,597·5	—	—
10–14 ...	2,796·3	—	—	3,205·3	—	—
15–19 ...	2,470·8	44·7	0·4	2,883·0	42·2	0·3
20–24 ...	1,646·4	641·9	9·0	1,944·9	718·8	8·3
25–29 ...	782·7	1,220·3	32·3	1,354·5	2,874·8	89·8
30–34 ...	418·2	1,305·8	56·3			
35–39 ...	257·3	1,197·4	76·0	511·2	2,635·4	202·5
40–44 ..	196·4	1,104·4	104·5			
45–49 ...	142·8	936·4	121·2	286·3	1,887·6	309·2
50–54 ...	123·4	802·3	153·7			
55–59 ..	87·6	580·2	155·4	182·7	1,164·7	405·2
60–64 ...	79·2	447·7	194·2			
65–69 ...	52·9	276·6	179·3	138·7	599·8	636·1
70–74 ...	39·4	165·5	173·4			
75–79 ...	20·5	71·5	118·7			
80–84 ...	10·2	25·6	69·8			
85 and over...	4·2	6·7	34·1			

TABLE VII—*continued*

Population by Age and Marital Condition (Persons), 1851–1947—*continued*

Thousands

Age group	1891 Single	1891 Married	1891 Widowed	1901 Single	1901 Married	1901 Widowed
All ages ..	20,229 0	10,961 6	1,837·5	22,258·4	12,696·7	2,044·9
0– 4 ..	4,055·8	—	—	4,249 7	—	—
5– 9 ...	3,872·8	—	—	3,980·0	—	—
10–14 ..	3,675 8	—	—	3,811·1	—	—
15–19 ..	3,331·5	37 4	0·3	3,667·9	34 1	0·1
20–24 .	2,281 4	722·0	6 7	2,767·3	780·5	6 4
25–29 ..	1,704 7	3,172·2	83 9	1,409·1	1,766 9	27·4
30–34 ..				720·6	1,971 0	55 0
35–39 ...	611 6	2,950·2	209·6	470 3	1,864·8	88 1
40–44 ...				336·1	1,631 4	128·5
45–49 ..	337 0	2,152·0	353 0	240·4	1,371·9	169·7
50–54 ..				184 3	1,106·6	214 7
55–59 ..	199 4	1,245·8	449·3	130 6	828·4	236 3
60–64 ..				112 3	617·0	287·0
65–69 .				74·1	375 6	266·8
70–74 ..				52·9	212·7	245·0
75–79 ...	158·9	682·0	734 8	30 1	96·0	175·6
80–84 ...				15 3	32·3	101 0
85 and over...				6·2	7·5	43·2

Age group	1911 Single	1911 Married	1911 Widowed	1921 Single	1921 Married	1921 Widowed and divorced
All ages ...	23,952 9	14,633 6	2,244·9	23,451·1	16,743 4	2,574·7
0– 4 ...	4,387 2	—	—	3,794·2	—	—
5– 9 ..	4,210 6	—	—	3,996·4	—	—
10–14 ...	3,989 8	—	—	4,149·9	—	—
15–19 ...	3,772·1	27·1	0 1	3,936·6	44·2	0·3
20–24 ...	2,903·2	687·5	4·5	2,771·5	799·9	8·9
25–29 ...	1,629·6	1,813·3	22·0	1,452·4	1,835·6	48·6
30–34 ...	903 4	2,278·4	51·0	798·9	2,248·0	92·1
35–39 ...	602·5	2,249·0	86·5	588·3	2,362·1	119·0
40–44 ...	426·3	1,956·5	125·5	479·4	2,285·4	144·8
45–49 ...	328·2	1,665·5	173 0	409·6	2,103·9	182·6
50–54 ...	249·1	1,336·0	223·2	321·6	1,703·3	233·9
55–59 ...	177·0	1,006·5	261·3	250·5	1,300·7	280·2
60–64 ...	137·6	713·2	298·6	190 7	927 0	325 7
65–69 ...	101·4	481·5	328·5	137·1	609·0	363·4
70–74 ...	70·9	264 3	298 7	90·3	323·5	326·5
75–79 ...	37 8	110·3	204·4	50·8	143·7	248 0
80–84 ...	17·7	35·4	111 5	23·3	45·7	135·6
85 and over...	8·3	9·2	55·9	10 0	11·4	65 0

TABLE VII—*continued*

Population by Age and Marital Condition (Persons), 1851–1947—*continued*

Thousands

Age group	1931			1939 (estimated)		
	Single	Married	Widowed and divorced	Single	Married	Widowed and divorced
ll ages ..	23,103 5	18,856 7	2,835 1	22,109	21,205	3,152
0– 4	3,413 6	—	—	3,263	—	—
5– 9 ...	3,778·4	—	—	3,228	—	—
10–14 .	3,633 1	—	—	3,460	—	—
15–19 .	3,831 9	41·7	0·1	4,003	72	—
20–24 ..	3,143 1	768 9	4 1	2,528	856	3
25–29	1,674 3	2,050·5	21 4	1,582	2,278	22
30–34 ..	825 9	2,528 2	50·5	920	2,889	44
35–39 ...	562 6	2,466·3	90 3	657	2,858	81
40–44 ..	458·7	2,352·8	144 1	485	2,546	121
45–49 ...	413 6	2,222·7	198 2	414	2,352	187
50–54 ...	370 8	2,020 9	256·3	373	2,112	273
55–59 .	315 6	1,673·2	317 6	338	1,843	350
60–64 ...	248·6	1,221·4	378·8	295	1,463	438
65–69 ..	191 9	805·5	422 1	234	1,024	483
70–74 ...	128·1	446 9	401 8	171	593	458
75–79 ...	69·7	187·9	302 5			
80–84 .	30 3	56 2	165 8	159	318	694
85 and over. .	13·0	13 5	81 2			

Age group	1947 (estimated)		
	Single	Married	Widowed and divorced
All ages ...	21,120	23,603	3,500
0– 4 ..	3,971	—	—
5– 9 ...	3,238	—	—
10–14 ..	3,152	—	—
15–19 ...	3,238	73	—
20–24 ...	2,394	1,131	6
25–29 .	1,233	2,395	32
30–34 ...	676	2,920	62
35–39 ...	560	3,195	89
40–44 ...	508	3,038	123
45–49 ...	458	2,696	171
50–54 ..	376	2,271	248
55–59 ...	337	1,948	339
60–64 ...	300	1,565	453
65–69 ...	254	1,151	563
70–74 ...	202	740	548
75 and over...	223	480	866

Sources:

1851: England and Wales: Census of Great Britain, 1851, Population Tables II, Vol. I, p. ccı.
Scotland: Census of Great Britain, 1851, Scotland, Part II, p. 3.

1861: England and Wales. Census of England and Wales, 1861, Vol. II, p. xx.
Scotland: Census of Scotland, 1861, Vol. II, Part II, p. 60.

1871: England and Wales: Census of England and Wales, 1871, Vol. III, p. xxiv.
Scotland: Census of Scotland, 1871, Vol. II, Table XII, p. 136.

1881: England and Wales: Census of England and Wales, 1881, Vol. III, p. v.
Scotland: Census of Scotland, 1881, Vol. 2, Table XIII, p. 142.

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1901: England and Wales: Census of England and Wales, 1901, General Report and Summary Tables, pp. 139, 182.
Scotland: Census of Scotland, 1901, Vol. 2, Table 1 (2), p. 34.

1911: England and Wales: Census of England and Wales, 1911, Vol. VII, p. 1
Scotland: Census of Scotland, 1911, Vol. 2, Table XXIV, p. 227.

1921: England and Wales: Census of England and Wales, 1921, General Tables, p. 138.
Scotland: Census of Scotland, 1921, Vol 2, Table 43, p. 171.

1931: England and Wales: Census of England and Wales, 1931, General Tables, p. 141.
Scotland Census of Scotland, 1931, Vol. II, p. 79.

1939: England and Wales: Registrar-General's Statistical Review for 1938–9, Text, pp. 157–8.
Scotland: supplied by the Registrar-General for Scotland.

1947: England and Wales: supplied by the Registrar-General for England and Wales.
Scotland: supplied by the Registrar-General for Scotland.

Notes:

1861: In the Scottish figures persons not classified by age, i.e. 2,562 single, 95 married and 38 widowed have been rateably distributed.

1911: In the Scottish figures 2,088 persons not classified by marital status, and 124 single, 33 married and 31 widowed persons not classified by age have been rateably distributed.

1921: In the Scottish figures 976 persons not classified by marital status, and 275 single, 219 married and 92 widowed and divorced persons not classified by age have been rateably distributed.

1931: In the Scottish figures 1,118 persons not classified by marital status, and 89 single, 39 married and 16 widowed and divorced persons not classified by age have been rateably distributed.

TABLE VIII

Population by Age and Marital Condition (Males), 1851–1947

Thousands

Age group	1851 Single	1851 Married	1851 Widowed	1861 Single	1861 Married	1861 Widowed
All ages .	6,407·1	3,368 9	380 7	6,942·5	3,876·3	407·4
0– 4 . .	1,365·8	—	—	1,567 3	—	—
5– 9 .	1,222·3	—	—	1,357 6	—	—
10–14 ...	1,126·5	—	—	1,225·3	—	—
15–19 . .	1,014 6	4 4	0·1	1,103·2	5·6	0·1
20–24 . .	741·1	180·5	2·4	773·0	212·6	2·4
25–29 .	361·9	432·4	9·4	343·7	483 0	9·0
30–34 . .	188 4	501 8	16 2	175·1	562 6	14 8
35–39 ...	113·1	474 3	21·2	106·2	542 6	20 0
40–44 ...	80·3	436 5	28·3	83 8	513·7	27·5
45–49 ...	56·1	362·1	31·2	57 4	426·5	31 9
50–54 ..	44·7	315·9	39·1	47·5	361·6	39·6
55–59 ...	30·2	224 1	37·1	32·3	268·6	41 2
60–64 . .	25·6	187·6	47·3	29 4	222·8	54·0
65–69 ...	15·3	115·9	42·5	17·8	133·7	48·6
70–74 .	11·4	76 4	44·5	12·4	84·1	49 7
75–79 ...	5 9	37 2	31·8	6·5	39·5	36·5
80–84 . .	2·6	15·1	19·8	2·9	15·1	22·2
85 and over. .	1·2	4 8	9·8	1·2	4·4	9 9

Age group	1871 Single	1871 Married	1871 Widowed	1881 Single	1881 Married	1881 Widowed
All ages ..	7,836·9	4,374 2	451 0	9,020·9	4,924·7	493 8
0– 4 ...	1,767·3	—	—	2,016·1	—	—
5– 9 .	1,555·4	—	—	1,796·4	—	—
10–14 ...	1,410·7	—	—	1,608·0	—	—
15–19 ...	1,245·4	6·5	0·1	1,451·5	6·4	0 1
20–24 ...	846·7	240·9	2 8	1,005 7	270·5	2·8
25–29 ...	387 3	561·0	10·9	} 677·1	1,363·1	30·4
30–34 ...	200·0	628·9	17 5			
35–39 ...	113 1	590·0	22·4	} 229·1	1,318·6	58·9
40–44 ...	85·0	555·4	29 6			
45–49 .	59·1	481·0	34·2	} 117·4	971·9	84 1
50–54 ...	51·5	422·0	43·2			
55–59 ..	36 0	312·9	44·5	} 70 6	635·0	113 3
60–64 . .	32·2	248 7	56·8			
65–69 ...	20·6	159 1	54·9	} 49 2	359·3	204·2
70–74 .	14·7	100·7	57·2			
75–79 ...	7·3	45 2	41·3			
80–84 ...	3·2	17·1	24·4			
85 and over...	1·2	4·7	11 2			

TABLE VIII—*continued*

Population by Age and Marital Condition (Males), 1851–1947—*continued*

Thousands

Age group	1891			1901		
	Single	Married	Widowed	Single	Married	Widowed
All ages ...	10,012·7	5,441 4	549 0	10,990 5	6,288 8	623·1
0– 4 ...	2,029 8	—	—	2,123·7	—	—
5– 9 .	1,935 1	—	—	1,988 3	—	—
10–14 ...	1,840·1	—	—	1,909·3	—	—
15–19 ..	1,670 0	6 0	0 1	1,832·8	5·0	—
20–24 ..	1,155 7	263·4	2·4	1,400 4	280·5	2·1
25–29 ..	834·4	1,500 1	28 7	702·3	797·5	9·8
30–34 .				340·1	949·8	18·7
35–39 ..	277 3	1,481·4	63·4	210 2	929·2	27·7
40–44 ...				148 8	828·2	39 1
45–49 ..	140 2	1,111·7	98 5	103·0	707·3	50 1
50–54 ..				78 0	579·4	62·6
55–59 ..	77 0	672 2	126 0	50·9	444·2	68·0
60–64 ...				44 3	338 2	83·6
65–69 .	53 0	406 6	230 0	26 5	213·1	79·8
70–74 ..				17·3	127 7	76·8
75–79 .				9·1	61·3	57·5
80–84 .				4·0	21·9	33·4
85 and over ..				1·4	5 5	13·9

Age group	1911			1921		
	Single	Married	Widowed	Single	Married	Widowed and divorced
All ages ..	11,815·9	7,240·1	698 5	11,373·5	8,308·7	740·7
0– 4 .	2,204 3	—	—	1,920 1	—	—
5– 9 ..	2,105 2	—	—	2,006·8	—	—
10–14 ..	1,994·4	—	—	2,083·8	—	—
15–19 ...	1,884 6	3·7	—	1,958·5	8·0	0·1
20–24 ..	1,466 5	236·3	1·6	1,364·0	285·0	1·9
25–29 ..	822·6	806·9	8·4	690·4	812·5	9·5
30–34 ..	436 1	1,091·4	18·6	345·5	1,072·0	18·9
35–39 ...	274·6	1,115·5	29·0	242·7	1,153·5	27·3
40–44 ...	186·4	982·2	39·6	195·5	1,136·1	37·3
45–49 ...	137 0	852·3	52·1	169·6	1,082·4	52·1
50–54 ..	102·4	696·9	67·1	130·3	897·8	68·3
55–59 ...	69·8	538·9	78·5	97·3	698·2	82·6
60–64 ..	55 1	389 9	92 0	70·8	509·4	97·0
65–69 ...	37·5	272·8	101·7	49·2	346 4	110·7
70–74 ...	22·6	154·6	91·8	28·1	187·6	99·6
75–79 ...	10·7	68·4	64·8	13 8	88·4	75·8
80–84 ...	4·3	23·7	35·8	5·3	29 4	41·1
85 and over...	1·7	6·7	17 4	2·0	7·6	18·5

TABLE VIII—*continued*

Population by Age and Marital Condition (Males), 1851–1947—*continued*

Thousands

Age group	1931 Single	1931 Married	1931 Widowed and divorced	1939 (estimated) Single	1939 (estimated) Married	1939 (estimated) Widowed and divorced
All ages .	11,266 5	9,364 4	827·6	10,885	10,552	895
0– 4 ..	1,723 8	—	—	1,662	—	—
5– 9 ...	1,907 3	—	—	1,632	—	—
10–14 .	1,835 0	—	—	1,739	—	—
15–19 ..	1,923 0	5·6	—	2,029	14	—
20–24 .	1,644 8	258·7	1 5	1,402	285	1
25–29 .	871 9	935 3	8·3	891	1,009	10
30–34 ...	362 0	1,216·2	17 2	431	1,442	14
35–39 .	204 5	1,198 8	23·6	278	1,448	26
40–44 ..	162·2	1,167 9	33·6	170	1,239	33
45–49 .	151 4	1,117 6	47·4	135	1,176	44
50–54 .	139 7	1,034·7	68 5	127	1,080	62
55–59 ..	120·5	890 4	92·0	118	960	87
60–64 ..	91 3	665 1	113·4	104	790	122
65–69 ..	64·8	453 3	128 0	79	574	144
70–74 ..	37 7	260 1	124·6	53	344	135
75–79 .	18·1	115 2	95·4			
80–84 ..	6·3	36·3	50·8	35	191	219
85 and over. .	2·0	9·1	23 0			

Age group	1947 (estimated) Single	1947 (estimated) Married	1947 (estimated) Widowed and divorced
All ages ..	10,551	11,855	932
0– 4 ..	2,034	—	—
5– 9 .	1,647	—	—
10–14 ..	1,601	—	—
15–19 ...	1,663	11	—
20–24 ...	1,407	363	1
25–29 ...	755	1,069	9
30–34 ..	342	1,457	19
35–39 ...	232	1,642	29
40–44 ..	181	1,586	37
45–49 ..	154	1,382	46
50–54 ...	123	1,141	54
55–59 ..	111	1,008	75
60–64 ..	96	829	108
65–69 ...	80	645	142
70–74 ..	62	430	156
75 and over...	62	292	256

Sources: As for Table VII.

Notes:

1861: In the Scottish figures males not classified by age, i.e 2,393 single, 58 married, and 16 widowed have been rateably distributed.

1911: In the Scottish figures 1,126 males not classified by marital status, and 57 single, 16 married and 5 widowed males not classified by age have been rateably distributed.

1921: In the Scottish figures 487 males not classified by marital status, and 152 single, 99 married and 33 widowed and divorced males not classified by age have been rateably distributed.

1931: In the Scottish figures 647 males not classified by marital status, and 50 single, 24 married and 6 widowed males not classified by age have been rateably distributed.

TABLE IX

Population by Age and Marital Condition (Females), 1851–1947

Thousands

Age group	1851			1861		
	Single	Married	Widowed	Single	Married	Widowed
All ages ..	6,433·0	3,437·9	788 7	7,060·1	3,949·9	892·4
0– 4 ...	1,353·8	—	—	1,551·2	—	—
5– 9 ...	1,209·9	—	—	1,350·0	—	—
10–14 ..	1,104·3	—	—	1,202 9	—	—
15–19 ...	1,012·2	25·5	0·3	1,098·4	33·0	0·3
20–24 ...	712·3	305·6	5 1	756 6	360·1	5·4
25–29 ..	365·3	514·7	17·2	368 2	579·9	18 4
30–34 .	196 8	534 9	31 5	202·8	600·7	33·2
35–39 ..	121·6	481·5	41·8	134·1	549·3	46 4
40–44 ...	90 0	427·4	59·7	102·6	502·1	67·0
45–49 ...	64·7	341·1	65 8	73·0	402·0	75·6
50–54 ...	56·6	286·0	85·2	62 0	325·8	94 5
55–59 ..	39·9	195·5	80·3	43 7	228·9	93·7
60–64 ..	39·0	154·3	105·5	43 5	176·6	123·9
65–69 ...	25·3	88·7	91 1	27 8	101·3	104·8
70–74 ...	20·3	51·6	87·6	21 8	57·6	99 3
75–79 ..	11·7	22·1	60·9	12 4	23·3	68·5
80–84 ..	6·5	7 2	37 2	6·5	7·4	40·8
85 and over...	3 0	1 9	19·5	2·7	1·8	20 5

TABLE IX—*continued*

Population by Age and Marital Condition (Females), 1851–1947—*continued*

Thousands

Age group	1871 Single	1871 Married	1871 Widowed	1881 Single	1881 Married	1881 Widowed
All ages ...	7,929·8	4,453·0	1,027·4	9,114 5	4,998 6	1,157·6
0– 4 ...	1,759·6	—	—	2,015 4	—	—
5– 9 .	1,555·9	—	—	1,801·1	—	—
10–14 . .	1,385 6	—	—	1,597·3	—	—
15–19 ...	1,225 4	38 2	0·3	1,431 5	35·9	0·2
20–24 ...	799·7	401 0	6 2	939 2	448 3	5 5
25–29 . .	395 4	659 3	21·4	677 4	1,511 7	59·4
30–34 . .	218·2	676·9	38·8			
35–39 ...	144·2	607·4	53 6	282·1	1,316·8	143·6
40–44 ...	111 4	549 0	74 9			
45–49 ...	83·7	455 4	87 0	168·9	915·7	225·1
50–54 .	71·9	380·3	110 5			
55–59 ...	51·6	267·3	110·9	112·1	529·7	291·9
60–64 ...	47 0	199·0	137·4			
65–69 ...	32·3	117 5	124 4	89 5	240 5	431·9
70–74 ...	24·7	64·8	116·2			
75–79 . .	13·2	26 3	77·4			
80–84 ...	7·0	8·5	45·4			
85 and over...	3 0	2·0	22·9			

Age group	1891 Single	1891 Married	1891 Widowed	1901 Single	1901 Married	1901 Widowed
All ages ...	10,216·3	5,520·2	1,288·5	11,267·9	6,407·9	1,421·8
0– 4 ...	2,026·0	—	—	2,126·0	—	—
5– 9 ..	1,937·7	—	—	1,991·7	—	—
10–14 ...	1,835·7	—	—	1,901·8	—	—
15–19 ...	1,661·5	31·4	0·2	1,835·1	29·1	0·1
20–24 . .	1,125·7	458·6	4·3	1,366·9	500 0	4·3
25–29 ...	870·3	1,672 1	55·2	706·8	969·4	17·6
30–34 ...				380·5	1,021 2	36·3
35–39 ...	334·3	1,468 8	146·2	260·1	935·6	60·4
40–44 ...				187·3	803·2	89·4
45–49 ...	196·8	1,040 3	254·5	137·4	664·6	119·6
50–54 ...				106·3	527 2	152·1
55–59 ...	122·4	573·6	323·3	79 7	384·2	168·3
60–64 . .				68·0	278 8	203·4
65–69 ...	105·9	275·4	504·8	47·6	162 5	187·0
70–74 ...				35·6	85·0	168·2
75–79 ..				21·0	34·7	118·1
80–84 ...				11·3	10·4	67·6
85 and over...				4·8	2·0	29·3

TABLE IX—*continued*

Population by Age and Marital Condition (Females), 1851–1947—*continued*

Thousands

Age group	1911			1921		
	Single	Married	Widowed	Single	Married	Widowed and divorced
All ages .	12,137·0	7,393·5	1,546·4	12,077 6	8,434·7	1,834 0
0– 4 .	2,182 9	—	—	1,874 1	—	—
5– 9 ..	2,105 4	—	—	1,989 6	—	—
10–14 ...	1,995 4	—	—	2,066·1	—	—
15–19 ...	1,887·5	23 4	0 1	1,978·1	36 2	0·2
20–24 ...	1,436·7	451·2	2 9	1,407·5	514 5	7 0
25–29 ...	807 0	1,006 4	13 6	762 0	1,023·1	39·1
30–34 ...	467 3	1,187 0	32 4	453·4	1,176 0	73 2
35–39 ...	327 9	1,133 5	57·5	345 6	1,208 6	91·7
40–44 ..	239 9	974 3	85·9	283 9	1,149·3	107·5
45–49 ..	191 2	813·2	120 9	240 0	1,021·5	130·5
50–54 ...	146·7	639 1	156·1	191·3	811·5	165·6
55–59 ..	107 2	467·6	182·8	153·2	602·5	197·6
60–64 ...	82·5	323 3	206·6	119·9	417 6	228·7
65–69 .	63 9	208·7	226 8	87 9	262 6	252·7
70–74	48 3	109·7	206 9	62·2	135·9	226·9
75–79 ..	27·1	41 9	139·6	37·0	55·3	172·2
80–84 ..	13·4	11·7	75·7	18·0	16·3	94·5
85 and over .	6 6	2 5	38·5	8·0	3·8	46·5

Age group	1931			1939 (estimated)		
	Single	Married	Widowed and divorced	Single	Married	Widowed and divorced
All ages ...	11,837·0	9,492·3	2,007·5	11,224	10,653	2,257
0– 4 ...	1,689 8	—	—	1,601	—	—
5– 9 ...	1,871·1	—	—	1,596	—	—
10–14 ...	1,798 1	—	—	1,720	—	—
15–19 ...	1,908·9	36·1	0·1	1,974	58	—
20–24 ...	1,498·3	510·2	2 6	1,126	571	2
25–29 ...	802·4	1,115·2	13·1	691	1,269	12
30–34 ...	463 9	1,312·0	33·3	489	1,447	30
35–39 ...	358·1	1,267 5	66·7	379	1,410	55
40–44 ...	296·5	1,184·9	110·5	315	1,307	88
45–49 ...	262·2	1,105·1	150·8	279	1,176	143
50–54 ...	231·1	986·2	187 8	246	1,032	211
55–59 ...	195·1	782 8	225·6	220	883	263
60–64 ..	157·3	556·3	265·4	191	673	316
65–69 ...	127·1	352·2	294·1	155	450	339
70–74 ..	90·4	186·8	277·2	118	249	323
75–79 ...	51·6	72 7	207 1			
80–84 ...	24·0	19·9	115·0	124	127	475
85 and over...	11·0	4·4	58·2			

TABLE IX—*continued*

ıtion by Age and Marıtal condıtion (Females), 1851–1947—*contınued*

Thousands

Age group	1947 (estımated)		
	Sıngle	Marrıed	Wıdowed and dıvorced
All ages ..	10,569	11,748	2,568
0– 4 ..	1,937	—	—
5– 9 ...	1,591	—	—
10–14 ...	1,550	—	—
15–19 .	1,575	62	—
20–24 .	987	768	5
25–29 .	478	1,326	23
30–34 ...	334	1,463	43
35–39 ..	328	1,553	60
40–44 .	327	1,452	86
45–49 ...	304	1,314	125
50–54 ..	253	1,130	194
55–59 ..	226	940	264
60–64 ...	204	736	345
65–69 ..	174	506	421
70–74 ...	140	310	392
75 and over .	161	188	610

Sources. As for Table VII.

Notes:

1861: In the Scottish figures females not classıfied by age, i.e. 169 sıngle, 37 married aı 22 wıdowed, have been rateably dıstributed.

1911: In the Scottısh figures 962 females not classıfied by marital status and 67 singl 17 married and 26 wıdowed females not classıfied by age have been rateat dıstributed.

1921: In the Scottish figures 489 females not classıfied by marıtal status and 123 sing 120 marrıed and 59 widowed and dıvorced not classıfied by age have been rateat dıstributed.

1931: In the Scottish figures 471 females not classıfied by marital status and 39 sing 15 married and 10 widowed and dıvorced not classified by age have been rateat dıstributed.

TABLE X

Annual Live Births, 1855–1947

Year	Estimated total number of live births (rounded to thousands)
1855	766,000
1856	795,000
1857	800,000
1858	790,000
1859	826,000
1860	817,000
1861	829,000
1862	844,000
1863	859,000
1864	874,000
1865	881,000
1866	886,000
1867	900,000
1868	919,000
1869	902,000
1870	923,000
1871	927,000
1872	957,000
1873	961,000
1874	990,000
1875	984,000

Year	Number of live births registered		
	Legitimate	Illegitimate	Total
1876	961,879	52,623	1,014,502
1877	962,299	52,723	1,015,022
1878	965,938	52,741	1,018,679
1879	953,203	52,916	1,006,119
1880	953,082	53,131	1,006,213
1881	956,209	53,604	1,009,813
1882	961,471	53,701	1,015,172
1883	962,420	52,760	1,015,180
1884	982,801	53,106	1,035,907
1885	966,897	53,473	1,020,370
1886	978,306	53,344	1,031,650
1887	958,235	52,514	1,010,749
1888	952,439	50,698	1,003,137
1889	958,330	50,397	1,008,727
1890	943,810	47,653	991,463
1891	991,715	48,428	1,040,143
1892	976,171	46,829	1,023,000
1893	993,357	48,325	1,041,682
1894	967,249	47,407	1,014,656
1895	1,000,745	48,040	1,048,785
1896	996,381	48,122	1,044,503
1897	1,003,083	47,477	1,050,560
1898	1,006,822	47,204	1,054,026
1899	1,013,776	45,603	1,059,379
1900	1,013,115	45,348	1,058,463
1901	1,017,441	44,558	1,061,999
1902	1,027,802	44,974	1,072,776
1903	1,036,199	45,597	1,081,796
1904	1,031,308	46,684	1,077,992
1905	1,014,306	46,397	1,060,703
1906	1,020,390	46,696	1,067,086
1907	1,001,902	44,980	1,046,882
1908	1,025,103	46,642	1,071,745
1909	996,262	46,879	1,043,141
1910	975,337	45,684	1,021,021
1911	956,155	46,833	1,002,988
1912	949,010	46,517	995,527
1913	955,949	46,457	1,002,406

TABLE X—*continued*

Annual Live Births, 1855–1947—*continued*

Year	Totals of estimated live births occurring in England & Wales and live births registered in Scotland (rounded to hundreds)		
	Legitimate	Illegitimate	Total
1914 ...	952,100	46,000	998,000
1915 .	869,500	43,400	912,900
1916 ...	845,800	45,300	891,100
1917 ...	714,900	44,000	758,900
1918 . .	692,400	48,100	740,500
1919 ...	784,300	52,500	836,900
1920 ...	1,040,200	55,300	1,095,500
1921 ...	923,800	47,400	971,200
1922 ...	848,300	41,800	890,100

Year	Number of live births registered		
	Legitimate	Illegitimate	Total
1923 ...	831,034	38,999	870,033
1924 ...	799,451	37,382	836,833
1925 ...	778,992	35,727	814,719
1926 ...	760,375	36,637	797,012
1927 ...	714,843	36,001	750,844
1928 ...	720,229	36,860	757,089
1929 ...	700,081	36,472	736,553
1930 ...	706,728	36,632	743,360
1931 . .	689,554	34,747	724,301
1932 ...	671,505	33,467	704,972
1933 . .	635,587	31,372	666,959
1934 ...	654,574	31,904	686,478
1935 ...	655,802	30,882	686,684
1936 ...	663,581	30,639	694,220
1937 ...	667,622	30,745	698,367
1938 ...	678,003	31,828	709,831

Year	Totals of live births occurring in England & Wales and live births registered in Scotland		
	Legitimate	Illegitimate	Total
1939 ...	670,616	30,762	701,378
1940 ..	645,799	30,724	676,523
1941 ...	631,872	36,962	668,834
1942 ...	699,278	42,922	742,200
1943 ..	728,134	50,882	779,016
1944 ...	784,699	62,720	847,419
1945 ...	695,995	70,874	766,869
1946 . .	864,302	60,823	925,125
1947 ...	941,259	52,914	994,173

Sources:

England and Wales:
1855–75: Professor D. V. Glass (See Note 1 below).
1876–80: Registrar General's Annual Report, 1911, p. 19.
1881–1913: Registrar General's Statistical Review, 1921, Civil, p.4.
1914–22: Registrar General's Statistical Review, 1938–39, Text, p. 235.
1923–46: Registrar General's Statistical Review, 1946, Civil, p. 4.
1947 : Figures supplied by the Registrar General.

Scotland:
1855–1946: Ninety-Second Annual Report of the Registrar-General for Scotland, 1946, pp. 79 and 80.
1947 : Registrar-General's Quarterly Return, No. 376, p. 14.

Notes:

1. Registration of births began in England and Wales in 1837, in Scotland in 1855. There is evidence that in the years before 1875 a considerable proportion of births in England and Wales failed to be registered. Professor Glass has made estimates of the actual numbers of births in England and Wales in these years. The figures given in the table for 1855–75 were obtained by adding Professor Glass's estimates for England and Wales to the Scottish registration figures (which are believed to be substantially complete). The numbers of births actually registered in Great Britain in these years were as follows.

Year	Legitimate	Illegitimate	Total
1855	680,252	48,140	728,392
1856	707,928	51,346	759,274
1857	714,625	51,861	766,486
1858	706,840	52,659	759,499
1859	741,958	54,466	796,424
1860	736,248	53,429	789,677
1861	749,329	54,086	803,415
1862	764,155	55,598	819,753
1863	778,669	58,089	836,758
1864	793,963	58,645	852,608
1865	803,292	57,847	861,139
1866	810,363	57,174	867,537
1867	826,059	56,334	882,393
1868	844,680	57,692	902,372
1869	830,978	55,757	886,735
1870	852,332	55,845	908,177
1871	857,704	55,852	913,556
1872	888,979	55,693	944,672
1873	895,392	54,086	949,478
1874	924,573	54,094	978,667
1875	922,586	51,599	974,185

2. In the *Statistical Review for England and Wales*, 1938–39, *Text*, the Registrar-General says (page 235, footnote) of the years 1914–22: "for these years the actual occurrences were not adequately reflected by the numbers registered owing to changes in registration time lag associated with successive food rationing and de-rationing procedures and to abnormal changes in the numbers of births themselves; the numbers registered have therefore been adjusted in the light of information bearing on the changes, to correspond as far as possible with the true occurrences." In Scotland, where the period allowed for registration of births is shorter, it is believed that these considerations do not apply to the same extent. The figures in the table were obtained by adding the Registrar-General's estimates for England and Wales to the Scottish registrations. The numbers actually registered in each year in Great Britain were as follows (the total of these exceeds the total of the 1914–22 figures in the table, reflecting a fall, between the beginning and end of the period, in the estimated number of births awaiting registration.

Year	Legitimate	Illegitimate	Total
1914	956,822	46,208	1,003,030
1915	884,675	44,120	928,795
1916	849,976	45,486	895,462
1917	721,335	44,452	765,787
1918	711,909	49,306	761,215
1919	748,406	50,300	798,706
1920	1,039,177	55,151	1,094,328
1921	924,640	47,375	972,015
1922	853,190	42,019	895,209

3. For 1939 onwards the Registrar General for England and Wales has published the number of births occurring in each year. The figures given in the table represent the sums of these and the numbers of births *registered* in Scotland. The total numbers of births registered in Great Britain in 1939 and later years were as follows.

Year	Number of live births registered	Year	Number of live births registered
1939	706,251	1944	840,784
1940	693,432	1945	772,205
1941	676,971	1946	924,300
1942	744,736	1947	999,967
1943	777,894	1948 (provisional)	877,991

TABLE XI

Annual Number of Marriages, 1855–1948

Year	Number of Marriages	Year	Number of Marriages
1855	171,793	1902	293,663
1856	180,077	1903	293,454
1857	180,466	1904	290,127
1858	175,725	1905	292,012
1859	188,924	1906	303,180
1860	191,381	1907	309,719
1861	184,602	1908	296,546
1862	184,627	1909	290,652
1863	195,744	1910	298,623
1864	203,112	1911	306,787
1865	209,085	1912	316,340
1866	211,464	1913	320,259
1867	201,772	1914	329,429
1868	198,817	1915	397,118
1869	199,114	1916	311,265
1870	205,509	1917	289,276
1871	214,131	1918	321,692
1872	226,908	1919	413,471
1873	232,363	1920	426,736
1874	228,400	1921	360,095
1875	227,186	1922	333,899
1876	228,453	1923	327,608
1877	220,169	1924	328,744
1878	214,412	1925	328,145
1879	205,601	1926	311,104
1880	216,470	1927	340,923
1881	223,294	1928	336,176
1882	231,001	1929	346,283
1883	233,253	1930	348,424
1884	230,407	1931	344,499
1885	223,049	1932	340,341
1886	220,586	1933	352,392
1887	225,394	1934	379,241
1888	229,126	1935	387,524
1889	240,209	1936	392,540
1890	250,497	1937	397,494
1891	254,495	1938	400,484
1892	255,805	1939	485,930
1893	245,834	1940	524,071
1894	254,053	1941	436,541
1895	256,626	1942	417,146
1896	273,034	1943	334,609
1897	280,195	1944	339,731
1898	287,491	1945	446,268
1899	295,312	1946	431,391
1900	289,924	1947	445,616
1901	290,787	1948 (provisional)	436,839

Sources.

England and Wales: 1855–1870: Registrar General's 47th Annual Report, p. xxxvii.
1871–1905: Registrar General's 83rd Annual Report, p 4.
1906–1946: Registrar General's Statistical Review, Part II, 1946, p. 4.
1947–1948: Registrar General's Quarterly Return, No. 400, p. 1.

Scotland: 1855–1945: Ninety-Second Annual Report of the Registrar-General for Scotland, 1946, pp. 79 and 80.
1947–1948: Registrar-General's Quarterly Return, No. 376, p. 14.

TABLE XII

Marriages by Civil Condition of Persons Married, 1900–1946

Year	Males			Females		
	Bachelors	Widowers	Divorced Men	Spinsters	Widows	Divorced Women
1900	262,529	27,122	267	270,443	19,227	248
1901	262,492	28,014	280	270,237	20,279	270
1902	266,680	26,650	320	273,808	19,540	302
1903	267,337	25,746	353	274,246	18,869	321
1904	265,145	24,582	379	271,929	17,817	360
1905	266,719	24,893	376	273,580	18,063	345
1906	277,415	25,301	445	284,457	18,295	409
1907	283,210	26,073	405	290,694	18,579	415
1908	270,699	25,361	465	277,909	18,181	435
1909	265,425	24,716	487	272,818	17,360	450
1910	273,062	25,073	480	280,155	18,022	438
1911	280,772	25,520	477	287,742	18,586	441
1912	290,252	25,555	518	296,860	18,977	488
1913	293,746	25,948	535	299,688	19,990	551
1914	302,595	26,263	562	307,597	21,235	588
1915	367,848	28,706	559	370,953	25,622	538
1916	282,381	28,281	596	284,824	25,850	584
1917	259,649	29,062	564	260,609	28,164	502
1918	289,450	31,603	635	287,738	33,410	540
1919	370,823	41,793	853	362,700	49,965	804
1920	386,263	39,005	1,464	381,616	43,890	1,226
1921	326,763	31,585	1,747	326,885	31,744	1,466
1922	303,262	28,564	2,073	306,465	25,783	1,651
1923	298,269	27,495	1,844	303,413	22,666	1,529
1924	299,503	27,444	1,797	305,612	21,646	1,486
1925	299,006	27,234	1,904	306,468	20,097	1,579
1926	283,704	25,510	1,890	291,204	18,262	1,638
1927	311,425	27,389	2,109	319,780	19,263	1,880
1928	307,242	26,475	2,458	315,578	18,508	2,089
1929	316,285	27,395	2,603	325,786	18,242	2,255
1930	319,198	26,696	2,530	328,759	17,424	2,241
1931	315,704	26,073	2,722	325,385	16,719	2,395
1932	312,247	25,347	2,747	322,178	15,628	2,535
1933	323,653	25,789	2,950	334,243	15,575	2,574
1934	349,593	26,382	3,266	360,279	16,205	2,757
1935	357,712	26,498	3,314	368,431	16,243	2,850
1936	362,569	26,190	3,781	373,135	16,156	3,249
1937	366,079	27,310	4,105	376,674	17,244	3,576
1938	367,901	27,792	4,791	378,617	17,730	4,137
1939	451,122	28,613	6,195	462,287	18,200	5,443
1940	488,649	29,395	6,027	498,890	19,737	5,444
1941	397,915	29,205	9,421	406,115	21,065	9,361
1942	381,839	29,365	5,942	390,786	21,584	4,776
1943	300,310	27,482	6,817	307,988	21,144	5,477
1944	303,732	27,328	8,671	310,951	22,259	6,521
1945	404,322	30,120	11,826	409,177	28,123	8,968
1946	381,264	32,206	17,921	383,961	33,056	14,374

Sources:

England and Wales 1900–20: Registrar General's Annual Reports.
1921–45: Registrar General's Annual Statistical Reviews, Part II.
1946: Supplied by the Registrar General.

Scotland. 1900–45: Registrar General's Annual Reports.
1946: Supplied by the Registrar General.

Note: Marriages of divorced persons in Scotland were classified as bachelor and spinster marriages up to 1932. The numbers of divorced men and women marrying in these years have been specially estimated. For the year 1933 the figures for spinster and bachelor marriages exclude marriages in which the other partner was a divorced person, and figures are given for (*a*) the number of marriages of divorced men; (*b*) the number of marriages of divorced women; and (*c*) the number of marriages in which both partners were divorced persons. For this year therefore the numbers of marriages of spinsters included in (*a*) and of bachelors included in (*b*) were specially estimated. From 1934 onwards the numbers of marriages of persons of each marital condition have been given by the Registrar General.

TABLE XIII

Estimated Number of First Marriages of Men under 55 and of Women under 45, 1900–1946

	Marriages of Bachelors under 55 years of age	Marriages of Spinsters under 45 years of age
	Figures rounded to hundreds	
1900	262,000	268,000
1901	262,000	267,700
1902	266,200	271,400
1903	266,800	271,800
1904	264,600	269,600
1905	266,200	271,100
1906	276,900	281,800
1907	282,600	287,900
1908	271,100	275,000
1909	264,800	269,900
1910	272,400	277,100
1911	280,100	284,300
1912	289,400	293,300
1913	292,900	296,200
1914	301,700	304,000
1915	366,900	337,600
1916	281,400	280,700
1917	258,500	256,400
1918	288,000	282,800
1919	369,300	355,600
1920	384,800	376,400
1921	325,400	322,200
1922	301,900	302,200
1923	297,000	299,100
1924	298,200	301,100
1925	297,500	301,800
1926	282,300	286,600
1927	309,600	314,600
1928	305,400	310,600
1929	314,500	320,600
1930	317,400	323,500
1931	313,900	320,200
1932	310,600	317,300
1933	322,000	329,100
1934	347,900	355,000
1935	356,000	363,100
1936	360,800	367,800
1937	364,300	371,100
1938	366,500	372,700
1939	449,200	456,000
1940	486,600	492,300
1941	396,200	400,000
1942	379,800	384,200
1943	298,400	301,700
1944	302,200	304,500
1945	402,300	401,800
1946	379,100	376,000

Sources: As for Table XII.

Notes: See Note to Table XII. In addition to the estimates of the numbers of marriages of divorced persons made for Table XII, it was necessary for the purposes of Table XIII to estimate also—

(*a*) for years up to 1932, the numbers of divorced persons marrying in Scotland (i) for men, at ages under 55; (ii) for women, at ages under 45,

(*b*) for years after 1932, the number of marriages in Scotland in which a divorced person married a bachelor aged under 55 or a spinster under 45.

TABLE XIV

Annual Deaths, 1855–1948

Year	Number of deaths registered in Great Britain (Persons)	Year	Number of deaths registered in Great Britain (Persons)
1855	487,707	1902	613,479
1856	449,035	1903	590,630
1857	481,721	1904	627,765
1858	513,195	1905	594,567
1859	502,495	1906	606,916
1860	490,891	1907	601,517
1861	497,455	1908	598,294
1862	503,761	1909	592,635
1863	545,318	1910	555,515
1864	569,947	1911	599,542
1865	561,800	1912	559,279
1866	572,037	1913	578,044
1867	540,141	1914	590,299
1868	550,038	1915	643,884
1869	570,703	1916	578,857
1870	589,494	1917	568,405
1871	589,591	1918	690,053
1872	568,059	1919	579,352
1873	569,466	1920	534,309
1874	607,352	1921	524,839
1875	628,220	1922	559,685
1876	584,444	1923	508,068
1877	574,433	1924	543,592
1878	616,665	1925	538,348
1879	599,602	1926	517,584
1880	604,427	1927	550,439
1881	564,260	1928	525,660
1882	589,643	1929	603,409
1883	599,888	1930	519,712
1884	605,996	1931	555,859
1885	597,357	1932	550,174
1886	610,916	1933	561,313
1887	605,304	1934	540,551
1888	582,145	1935	542,732
1889	591,591	1936	562,513
1890	641,252	1937	578,516
1891	671,498	1938	541,949
1892	635,229	1939	564,315
1893	649,628	1940	654,312
1894	569,940	1941	607,738
1895	650,849	1942	545,100
1896	597,404	1943	568,145
1897	620,631	1944	556,779
1898	630,538	1945	550,763
1899	661,392	1946	556,695
1900	670,126	1947	583,815
1901	631,692	1948	531,260

Sources:

England and Wales:

1855–1894: Registrar General's 67th Annual Report (1904), Table 2, p. cx.
1895–1945: Registrar General's Annual Statistical Review, 1945, Tables, Part I Medical, pp. 2–3.
1946–1948: Registrar General's Quarterly Return No. 400, p. 1.

Scotland:

1855–1946: 92nd Annual Report of the Registrar-General for Scotland, 1946, pp.79–80.
1947–1948: Registrar-General's Quarterly Return No. 376, p. 14.

Notes:

The figures are of deaths registered in Great Britain. Thus deaths abroad, e.g. those of members of the Armed Forces serving overseas in the wars of 1914–18 and 1939–45, are not included. On the other hand the deaths in Great Britain of members of the Armed Forces or of civilian war casualties are included.

Population Projections for Great Britain, 1947-2047

REPORT BY THE ASSISTANT SECRETARY*

I. SCOPE OF THE REPORT

1. In the tables at the end of this report are given sixteen projections of the population of Great Britain from 1947 to 2047. These projections were prepared under the direction of the Statistics Committee as a basis for the treatment by the Royal Commission on Population in its report of possible future trends of population in Great Britain. Chapters 8 and 9 of the Royal Commission Report contain a discussion of the various factors which will determine the future movement of population, and present the conclusions drawn by the Royal Commission from a study of the projections. The present report, which is really an appendix to those chapters, does not attempt to carry further either the examination of the probable future of the determining factors (mortality, fertility, etc.) or the discussion of the results. Its purposes are limited to (1) the description of the procedures used in preparing the projections, with particular attention to any features which may be unfamiliar(1), and (2) the presentation of the full numerical results. Any attempt to justify in detail the choice of assumptions or methods used would involve traversing again much of the ground covered in other papers in this volume, and no such attempt is made. It may, however, be remarked that in all its main features the procedure adopted reflects the influence of the approach to current problems of demographic analysis outlined in the introductory memorandum.

II. GENERAL ACCOUNT OF THE PROJECTIONS

A. Outline of the Procedure

2. The starting point of all the projections was the population of Great Britain in mid-1947, divided into quinquennial age groups for each sex, being the sum of the estimates made for their respective countries by the Registrars General for England and Wales and for Scotland. The object was to obtain future populations in similar age and sex groups at quinquennial intervals over the hundred years from 1947 to 2047. The necessary calculations may be divided into several distinct stages. First came the calculation of the numbers of the population already alive in 1947 who would still be alive in 1952, 1957, and so on. Given the life tables derived from the mortality assumed to be in operation in each of the various future quinquennia, this was a straightforward computation on familiar lines. The next stage was the calculation of the number of births in successive future quinquennia. This was done by a twofold procedure, involving first the calculation of future marriages and then the calculation of future births from the relevant marriages (past and future). Thus, in the first instance, a series of factors were applied to the unmarried population of 1947 to yield the projected number of marriages in each of the three 5-year periods 1947–52, 1952–57 and 1957–62. The calculation could not proceed further into the future until the births of 1947–52 had been calculated (since some of the marriages of 1962–67 may be expected to occur to persons born in 1947–52). The births of 1947–52 were therefore calculated by applying to the marriages of 1947–52, and of quinquennia previous to 1947,

(1) The technique of calculation owes much to suggestions made by Mr. J. Hajnal.

fertility factors representing the rate at which the marriages of a given quinquennium might be assumed to give rise to births in the same quinquennium and in subsequent quinquennia. These factors allow for illegitimate as well as legitimate births. The births of 1947–52 thus obtained were entered in the form used for projecting marriages, so enabling that process to be carried one quinquennium further. By these interacting calculations the number of future births could be computed as far ahead as was desired. To the births thus computed for future quinquennia, life table factors were applied so as to yield the numbers of the resulting population at various subsequent dates. The populations resulting from the projected births were then combined with the populations of survivors of the 1947 population to produce the complete population at each of the future dates for which it was required.

3. To illustrate the effect of net emigration or immigration on the trend of population, further calculations were required, and for this purpose the migrants were considered as a separate population. Given the assumed number and age and sex distribution of the net flow of migrants, the resulting 'migrant population' at each subsequent date was calculated, allowance being made for deaths among the migrants and for births to them. The resulting 'migrant populations' at each date were then added to, or subtracted from, the figures obtained by projecting the population without regard to migration.

B. Assumptions

4. The assumptions on which the projections have been calculated may be considered under four heads, namely (1) mortality, (2) marriage, (3) fertility and (4) migration. Under each head two or more alternative assumptions were framed. In this section only a general account of the assumptions is given; statistical detail is reserved for the next section (Computational Notes). For convenience of reference each assumption has been given a summary description.

MORTALITY

Assumption 1: 'Constant Mortality'

5. Under this assumption future mortality was supposed to remain at the same level as in Great Britain in 1942–44. From the mortality rates of this period a life table was specially prepared by the Government Actuary's Department. Details of the construction are given in their memorandum (p. 54); a table of the 'stationary populations' derived from this life table and used in the projections is given below (Table III).

Assumption 2: 'Declining Mortality'

6. As described in the note appended to the memorandum by the Government Actuary's Department on the future trend of mortality (p. 78), it was assumed that mortality would for some time continue to decline in accordance with the trends recorded over the past 50 years. The period of decline was 30 years, i.e. from 1947 to 1977, after which, it was assumed, the level of mortality then reached would be maintained indefinitely. Figures from the life tables thus obtained for each quinquennial period are given in Table IV below.

MARRIAGE

Assumption 1: 'Female Nuptiality, 1942–47'

7. It was assumed that marriage rates among spinsters of various ages would remain at the level estimated for Great Britain from the changes in proportions married over the 5 years mid-1942 to mid-1947.

Assumption 2: 'Male Nuptiality, 1942–47'

8. It was assumed that marriage rates among bachelors of various ag would remain at the levels estimated for Great Britain over the 5 years mid-194 to mid-1947.

Assumption 3: 'Intermediate, 1942–47'

9. It was assumed that the number of marriages in each future quinquenniu would be half way between the numbers which would have resulted from ma and female nuptiality of 1942–47 respectively.

Assumption 4: 'Later Marriage'

10. Under this assumption future marriage rates (among women under 2 in 1947) were so constructed as to imply a rise of the average age at marriag to its 1938 level, i.e. about a year higher than is implied by the marriage rat of 1942–47 employed in Assumption 1. The proportion of women marryin by age 45 was assumed to remain the same as in Assumption 1: thus the effe of a rise in age at marriage could be isolated.

Assumption 5: 'Earlier Marriage'

11. Under this assumption future marriage rates of women under 20 i 1947 were so constructed as to imply a further decline in the average age a marriage beyond the 1942–47 level, the extent of the decline being similar t that of the rise involved in Assumption 4.

FERTILITY

Assumption 1: 'Fertility of 1935–38'

12. For marital fertility, the assumption was that the fertility rates a various durations of marriage would remain at the levels estimated for Grea Britain in 1935–38. Allowance was made for illegitimate fertility by increasin the fertility factors in a fixed proportion, the proportion being derived fron the pre-war fertility rates of unmarried women by a method which mad allowance for the decline which has taken place in the unmarried populatio since 1939.

Assumption 2: '5 per cent. above 1935–38'

13. The factors assumed were each 5 per cent. higher than the correspondin factors of Assumption 1. This level of fertility is *roughly* equivalent to th maintenance of average family size at the level which it is estimated will b attained by the couples married in the period 1927–38(1).

Assumption 3: 'Exact Replacement'

14. The factors assumed were each 6·34 per cent. higher than those o Assumption 2. This level is so calculated that the factors yield, when applie to a generation exposed to the ultimate mortality of the 'declining mortality assumption and to the 'intermediate 1942–47' level of marriage rates, a tota of births equal to the original size of the generation itself. In this sense the assure ultimately the exact replacement of the population.

(1) The average gross fertility of marriages taking place in 1927, estimated from the total number of births to marriages still existing in 1948, was about 4 per cent. above the total of (gross) duration-specific fertility rates of 1935–38 (see para. 17 of the computational note attached to Appendix 3 of the Royal Commission Report). It is shown in Chapter 6 of the Royal Commission Report that the average size of completed families of couples married in the years 1928–38 is likely to be about the same as that of the 1927 cohort.

Assumption 4: 'Falling Fertility'

15. This assumption represents a considerable decline in the average size of the family over the next 20 years. The assumption was that while couples married before 1947 would have the fertility of Assumption 2 ('5 per cent. above 1935–38'), those married in the four quinquennia between 1947 and 1967 would have fertility rates respectively 5 per cent., 10 per cent., 15 per cent. and 20 per cent. lower. Among couples married after 1967 it was assumed that fertility would remain constant at a level 80 per cent. of that of Assumption 2.

Assumption 5: 'Rising Fertility'

16. This assumed a rise in fertility exactly converse to the fall in Assumption 4; thus the level reached among the couples married in 1962–67 and maintained thereafter was 20 per cent. higher than that of Assumption 2.

MIGRATION

Assumption 1: No Net Migration

Assumption 2: Net Emigration 100,000 *a year*

17. A net emigration of 100,000 persons a year was assumed. The age and sex distribution of this flow was assumed to be similar to that of the emigrants from Great Britain in the period 1921–32.

Assumption 3: Net Immigration 100,000 *a year*

Assumption 4: Net Emigration 50,000 *a year*

Assumption 5: Net Immigration 50,000 *a year*

18. In all these the age and sex distribution of the migrants were assumed to be similar to those of Assumption 2.

C. Combination of Assumptions

19. If a projection were made for each possible combination of the alternative assumptions described above, the number of projections would total 250. It was therefore necessary to select from the list of possible combinations a limited number sufficient to illustrate the potential influence on the trend of population of the chief governing factors. Table I shows in tabular form the sixteen combinations which were chosen.

20. Projections 1 to 5 are similar in their assumptions about mortality, fertility and migration: they differ only in the marriage assumption. Comparisons within this group therefore show the effect on the trend of marriages, births and population of various possible trends in marriage rates, e.g. the effect of the continuance of the male marriage rates of 1942–47 can be compared with that of the female marriage rates of the same period; the consequences of a further fall, or of a rise, in average age at marriage can be explored.

21. Projections 3 and 7 are similar in their assumptions about marriage, fertility and migration, differing only in respect of mortality. Projections 6 and 8 form another pair of which the same is true, though here the common fertility is different from that common to 3 and 7. Comparisons within these pairs of projections can be used to illustrate the effect on population trends of the decline in mortality assumed in Projections 7 and 8.

TABLE II

The revision of the base population, Great Britain, 1947

Thousands

Age Group (1)	Males: Original estimate (2)	Males: Revised estimate (3)	Males: Col. (3) −Col (2) (4)	Females: Original estimate (5)	Females: Revised estimate (6)	Females: Col. (6) −Col. (5) (7)
0– 4	2,041	2,034	− 7	1,944	1,937	− 7
5– 9	1,654	1,648	− 6	1,596	1,591	− 5
10–14	1,606	1,575	−31	1,560	1,530	− 30
15–19	1,666	1,700	34	1,639	1,657	18
20–24	1,737	1,771	34	1,742	1,760	18
25–29	1,799	1,819	20	1,813	1,827	14
30–34	1,811	1,810	− 1	1,836	1,840	4
35–39	1,902	1,898	− 4	1,943	1,941	− 2
40–44	1,835	1,801	−34	1,887	1,865	− 22
45–49	1,614	1,580	−34	1,741	1,743	2
50–54	1,335	1,317	−18	1,601	1,577	− 24
55–59	1,222	1,194	−28	1,464	1,430	− 34
60–64	1,045	1,033	−12	1,312	1,285	− 27
65–69	875	867	− 8	1,124	1,101	− 23
70–74	641	648	7	839	842	3
75–79	385	380	− 5	542	539	− 3
80–84	164	167	3	286	283	− 3
85 and over	67	62	− 5	140	136	− 4
Total	23,399	23,304	−95	25,009	24,884	−125

B. Life Tables

(i) *The* 1942–44 *Life Table*

26. Table III below gives the factors (stationary populations) from the 1942–44 life table used in the 'constant mortality' projections.

TABLE III

Stationary populations in quinquennial Age-groups, according to mortality of Great Britain, 1942-44

Age Group	Males (Radix = 1,000)	Females (Radix = 1,000)
0– 4	4,697	4,759
5– 9	4,634	4,706
10–14	4,607	4,684
15–19	4,574	4,655
20–24	4,522	4,609
25–29	4,461	4,555
30–34	4,400	4,501
35–39	4,331	4,443
40–44	4,242	4,374
45–49	4,114	4,279
50–54	3,922	4,147
55–59	3,641	3,963
60–64	3,253	3,699
65–69	2,737	3,312
70–74	2,109	2,759
75–79	1,398	2,038
80–84	728	1,242
85–89	281	582
90–94	75	191
95–99	12	38
100 & over	1	4

(ii) *Life Tables used in the 'Declining Mortality' assumption*

27. Table IV sets out the mortality factors employed for various future periods under the 'declining mortality' assumption. The figures given are not for stationary populations, as in Table II above, but are 'Group Survival Factors' representing the proportion of a given age group to the group 5 years previously of which it represents the survivors (or in the case of the 0–4 age group, to the births of the previous 5 years). These are given because it was in this form that the factors were used to age the populations over the assumed period of changing mortality 1947–77.

TABLE IV

'Group Survival Factors' (proportion surviving 5 years) in force at various periods under the 'falling mortality' assumption

Age Group occupied at end of 5-year period	1947–52		1952–57		1957–62		1962–67		1967–72		1972–77		1977 and later	
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
0– 4	94757	·95976	·95273	·96387	·95725	·96741	96121	97048	·96469	·97315	·96775	·97548	97046	·97752
5– 9	·98818	·99100	·98940	·99205	·99049	·99296	99144	·99375	99229	·99445	·99304	99504	99371	·99557
10–14	·99479	·99592	·99522	·99636	99561	·99675	·99597	·99710	·99630	·99742	99660	·99769	·99688	·99795
15–19	·99315	·99426	·99355	·99468	·99393	·99506	·99428	·99540	·99462	99573	·99493	99603	99522	99631
20–24	·98953	·99091	99005	99137	·99055	·99180	99104	99220	99148	·99259	·99191	·99296	99232	99331
25–29	·98781	·98933	·98866	·99000	98946	·99062	99020	99120	·99088	·99175	·99151	·99225	·99210	·99273
30–34	·98774	·98925	·98884	·99010	·98983	·99088	·99075	·99160	·99158	·99227	·99234	·99288	·99303	·99345
35–39	·98647	·98862	·98769	98957	·98880	·99044	·98981	99124	·99073	99198	99157	99265	99233	99327
40–44	·98143	·98609	·98312	·98746	·98465	·98869	·98604	98980	·98732	·99080	·98847	·99171	98952	99254
45–49	·97392	·98189	·97593	·98353	·97778	·98503	·97948	·98639	·98106	·98762	·98250	·98874	·98383	·98977
50–54	·95640	·97208	·95916	·97437	96174	·97648	·96417	·97842	·96644	98019	·96857	·98182	·97056	·98332
55–59	·93437	·95940	·93767	96237	·94079	·96513	·94375	96767	·94656	·97003	·94922	·97222	·95176	·97426
60–64	·89970	·93933	90391	94342	90793	·94723	·91177	·95073	·91549	·95405	·91902	95715	92245	96003
65–69	·85089	·90045	85559	·90565	·86012	·91056	·86452	·91520	·86876	·91962	87288	·92383	·87688	·92778
70–74	·77767	·84212	·78312	·84900	·78840	·85556	·79364	·86190	·79868	·86798	·80368	·87384	80853	·87940
75–79	·66240	·74003	·66684	·74730	·67107	·75436	·67531	·76123	·67960	·76794	·68368	·77445	·68772	·78074
80–84	·52151	·61525	·52473	·62301	·52767	·63067	·53069	·63818	·53405	64567	·53702	·65298	54007	66015
85–89	·39136	·47318	·39552	·47752	·39954	·48189	40375	48627	·40769	49052	·41181	·49479	·41580	·49892
90–94	·27132	·33446	·27613	·33958	·28083	·34477	·28579	·35002	·29044	·35513	·29535	·36030	30014	·36532
95–99	·16316	·20203	·16665	·20574	·17005	·20953	·17366	·21335	·17706	21710	·18065	·22089	·18417	·22459
100–104	·08111	·09699	·08284	·09878	·08454	·10060	·08633	·10243	·08802	·10423	08981	·10605	·09156	·10783

28. These group survival factors may be converted into stationary populations by a process of cumulative multiplication. Table V gives stationary populations for the constant mortality assumed to be reached in 1977 and maintained thereafter.

TABLE V

Stationary populations in quinquennial age-groups, according to mortality projected for Great Britain, 1977 and after, under 'falling mortality' assumption

Age Group	Males	Females
	Radix = 1,000	Radix = 1,000
0–4	4,857	4,888
5–9	4,822	4,866
10–14	4,807	4,856
15–19	4,784	4,838
20–24	4,747	4,806
25–29	4,710	4,771
30–34	4,677	4,740
35–39	4,641	4,708
40–44	4,592	4,673
45–49	4,518	4,625
50–54	4,385	4,548
55–59	4,173	4,431
60–64	3,850	4,253
65–69	3,376	3,946
70–74	2,729	3,470
75–79	1,872	2,709
80–84	1,014	1,789
85–89	422	892
90–94	127	326
95–99	23	73
100–104	2	8

C. The Projection of Marriages

29. The starting point for the calculation by which marriages were projected was a pair of nuptiality tables (for males and females respectively) computed by Mr. Hajnal from the changes in 'proportions married' in England and Wales between 1942 and 1947. His figures, together with an account of the method of computation, may be found in Note II to his Report on Births, Marriages and Reproductivity, England and Wales, 1938–1947, printed elsewhere in this volume.

30. Up-to-date estimates of population by marital status are not available for Scotland in sufficient detail to make possible a calculation for Great Britain similar to that made by Mr. Hajnal for England and Wales. In Scotland people have married both less and later than in England and Wales; in consequence, the proportions married at various ages have been consistently lower for Great Britain than for England and Wales. At ages over 50 the difference has been fairly steady at about 0·5 per cent. In the light of the differences shown in the figures for past years (particularly 1931 and 1939), a series of adjustments was constructed for each sex and these were applied to Mr. Hajnal's figures to yield figures estimated to be appropriate to Great Britain. The calculation is shown in Table VI.

TABLE VI

Estimation of gross nuptiality of Great Britain from that derived from changes in proportions married in England and Wales, 1942–47

I. Female Nuptiality					II. Male Nuptiality				
Age Group (1)	Proportion single according to proportions married, England and Wales, 1942–47 (2)	Adjustment from England and Wales to Great Britain (3)	Col. (2) + Col. (3) (Estimated Proportion single according to Gross Nuptiality of Great Britain, 1942–47) (4)	Successive differences of entries in Col. (4) (fall in proportion single between successive age-groups) (5)	Age Group (1)	Proportion single according to change in proportions married, England and Wales, 1942–47 (2)	Adjustment from England and Wales to Great Britain (3)	Col (2) + Col. (3) (Estimated Proportion single according to Gross Nuptiality of Great Britain 1942–47) (4)	Successive differences of entries in Col. (4) (fall in proportion single between successive age-groups) (5)
15–19	·9632	−·0004	·9628	·0372	15–19	·9918	—	·9918	0082
20–24	·5531	+·0087	·5618	·4010	20–24	·7863	+·0050	·7913	·2005
25–29	·2354	+·0071	·2425	·3193	25–29	·4015	+ 0100	4115	·3798
30–34	·1501	+·0067	·1568	·0857	30–34	·2071	+·0080	2151	·1964
35–39	·1198	+·0063	·1261	·0307	35–39	1284	+·0060	·1344	·0807
40–44	·1067	+·0058	·1125	·0136	40–44	·0949	+·0057	·1006	·0338
45–49	·1001	+·0053	1054	·0071	45–49	0777	+·0054	0831	·0175
					50–54	·0727	+·0052	·0779	·0052
					55–59	·0710	+·0050	·0760	·0019

31. For convenience in calculation the nuptiality conditions were expressed in the form of a series of factors which could be applied to the births of a quinquennium to show how many marriages result from them in subsequent quinquennia. The way in which this was done is shown for female nuptiality in Table VII. The figures in Column (4) of this table were taken from Column (5) of Table VI.

TABLE VII

Calculation of factors for projection of marriages in quinquennial periods, assuming female nuptiality of Great Britain, 1942–47

Age Group (1)	Stationary Population according to Life Table of Great Britain, 1942–44 (radix 1,000) (2)	Mean no. of survivors (per female birth) in passage from each age group to the next, according to Life Table of 1942–44 (Means of successive values in Col. (2), ÷ (radix × 5)) (3)	First marriages (per female birth) in passage from each age group to the next, according to Gross Nuptiality of Great Britain, 1942–47 (4)	Col (3) × Col. (4) (Factors for projecting marriages in quinquennial periods) (5)
10–14	4,684	·9339	·0372	·0347
15–19	4,655	·9264	4010	·3715
20–24	4,609	·9165	·3193	·2926
25–29	4,555	9057	·0857	·0776
30–34	4,501	·8945	0307	·0275
35–39	4,443	8817	·0136	·0120
40–44	4,374	·8653	·0071	·0061
45–49	4,279			

32. The meaning of the factors in column (5) may be explained as follows. Given the number of female births over a quinquennium, say 1947–52, multiplying this number by the first factor (·0347) gives the number of marriages the group would contract between 1962 (when its members would occupy the age group 10–14) and 1967 (when they would occupy the age group 15–19) on the assumption that throughout the period they would marry according to the estimated nuptiality of Great Britain 1942–47 and would die at the mortality rates of Great Britain 1942–44. Applying the second factor gives the number of marriages they would contract—on the same assumptions—between 1957 and 1962; and so on.

33. The final figure in the last column had to be corrected before it could be used, as was desired, to project the number of marriages of women aged under 45. As it stands this factor gives the number of first marriages (per original birth) which the cohort will contract in moving from the age group 40–44 to the group 45–49. Some of these marriages will be to women aged over 45. By interpolating(1) it can be calculated that the number of marriages under 45 is ·0036 and this was the factor applied in projection.

34. The stationary population in columns (2) and (3) of Table VII ought strictly to be based upon the mortality of the single, since only the single are at risk for first marriage, and it is the combined probabilities of survival and first marriage which it is the object of the table to compute. For women under 50 the mortality of the single differs only very slightly from that of all women, and it was therefore deemed unnecessary to complicate the calculation.

(1) A method of interpolation is described by Mr. Hajnal in Note II to the Report already referred to.

Among men, however, mortality is distinctly higher among the single. For this reason the life table used in the calculation of the factors for projection of marriages according to male nuptiality was based upon an estimate of the mortality, not of all men, but of bachelors only. The calculation is shown in Table VIII.

TABLE VIII

Calculation of factors for projection of marriages in quinquennial periods, assuming male nuptiality of Great Britain, 1942–47

Age Group (1)	Stationary Population according to life table of single males ([1]), Great Britain, 1942–44 (radix 1,000) (2)	Mean no. of survivors (per male birth) in passage from each age group to the next, according to life table of single, 1942–44, (Means of successive values in Col. (2), ÷ (radix × 5)) (3)	First marriages (per male birth) in passage from each age group to the next, according to gross nuptiality of Great Britain, 1942–47 (4)	Col. (3) × Col. (4) (Factors for projecting marriages in quinquennial periods) (5)
10–14.	4,607	·9181	·0082	·0075
15–19 .	4,574	·9092	·2005	·1823
20–24..	4,519	·8962	·3798	·3404
25–29...	4,443	·8790	1964	·1726
30–34...	4,347	8570	·0807	·0692
35–39...	4,224	·8294	·0338	·0280
40–44 ..	4,070	·7939	·0175	0139
45–49 .	3,869	·7464	·0052	·0039
50–54...	3,595	·6834	·0019	·0013
55–59..	3,238			

35. For a reason analogous to that mentioned in para. 33, the final figure in Column (5) must be altered to ·0009 before being used to project the number of marriages of men under 55.

36. A slight complication is involved in the application of these factors to the population already born in 1947. To apply the factors to the actual number of births from which this population was derived (which in any case we could not identify precisely owing to migration) would be justifiable only if throughout their past lives they had survived and married at the same rates as we are assuming for the future—which, in general, has certainly not been the case. The factors were therefore applied (so far as relevant, i.e. for the age-periods still remaining to these groups after 1947) not to the actual births but to a figure of 'assumed' births, being the number of births that *would* have been required, according to the mortality and marriage rates assumed for projection, to give rise to the number of spinsters or bachelors actually existing in each age group in 1947. This figure for 'assumed births' is calculated by dividing into the estimated spinster or bachelor population in each age-group a factor based on the number of spinsters or bachelors in the stationary population according to mortality of Great Britain 1942–44 and nuptiality of Great Britain 1942–47. The calculation of these factors is given in Table IX.

([1]) The stationary populations for single males were obtained by applying to the male stationary populations in each age group of the 1942–44 life table the ratio between the corresponding populations in the life tables (for single males and all males respectively) for England and Wales, 1938–9, given by Mr. Hajnal in his Report on Births, Marriages and Reproductivity, England and Wales, 1938–47 (Note I).

TABLE IX

Calculation of mean numbers of surviving spinsters and bachelors according to estimated Great Britain nuptiality of 1942–47 and mortality of 1942–44

I Female Nuptiality				II Male Nuptiality			
Age Group (1)	Mean No. of survivors (per female birth) according to mortality of Great Britain, 1942–44 (2)	Proportion single according to gross nuptiality of Great Britain, 1942–47 (3)	Col. (2) × Col. (3) Mean No. of spinsters (per female birth) (4)	Age Group (1)	Mean No. of survivors (per male birth) according to mortality of *single* males, Great Britain, 1942–44 (2)	Proportion single according to gross nuptiality of Great Britain, 1942–47 (3)	Col (2) × Col. (3) Mean No. of bachelors (per male birth) (4)
15–19	·9310	·9628	·8964	15–19	·9148	9918	·9073
20–24	·9218	·5618	·5179	20–24	9037	·7913	·7151
25–29	·9111	·2425	·2209	25–29	·8886	·4115	·3657
30–34	·9002	·1568	·1412	30–34	·8693	·2151	·1870
35–39	·8887	·1261	·1121	35–39	·8447	·1344	·1135
40–44	·8747	·1125	0984	40–44	8140	1006	0819
				45–49	·7737	0831	·0643
				50–54	·7191	·0779	·0560

37. An example of the actual projection of marriages may now be set out. Table X shows the projection of the first marriages of women under 45 in Projection 1. The populations of spinsters in Column (2) were compiled from estimates provided by the Registrars General.[1]

38. The diagonal line, leading up from left to right across columns (6) to (12) inclusive, contains all the marriages of a particular quinquennium. The diagonal totals given in column (13) therefore give the projected marriages for each future quinquennium, the dates of the quinquennium being given in column (14).

39. Table X carries the projection only so far as can be done from the 1947 population, with the result that the number of marriages is completely given only for the three quinquennia between 1947 and 1962. To carry the projection further it is necessary to have the projected number of births in 1947–52 to enter in column (4). This is obtained by applying fertility factors to the marriages of the past and to those projected for 1947–52. Thus the projection of births and marriages is a combined process, each part depending on the other, and the filling up of the table above is intermittent. But once both this and the table for projecting births are set up the calculation can be continued far ahead very quickly.

40. By a procedure analogous to that of Table IX the factors derived in Table VIII from male nuptiality of 1942–47 were used to project the first marriages of men under 55. In projecting births from these marriages, the fertility factors used were slightly different from those used in conjunction with the projected marriages of women. The average net fertility of first marriages of men under 55 comes out a little higher than that of the first marriages of women under 45. For Great Britain 1935–38 the former is 2·032, while the latter is 2·000 (see para. 45 below). It was assumed that this relation would continue to obtain, so that in terms of fertility the marriage of one man under 55 would be equivalent to 1·016 first marriages of women under 45.

41. For the purposes of the third marriage assumption, 'Intermediate 1942–47', the marriages of men projected according to Assumption 2 were first multiplied by 1·016 and then averaged with the female marriages projected according to Assumption 1 to yield the projected number of 'female equivalent marriages'. To these were applied the fertility factors appropriate to female marriages.

42. For the projection of marriages on the assumption of a return to pre-war habits in respect of age at marriage, the factors were based upon a comparison between the nuptiality tables of *England and Wales* for 1938 and 1942–47 respectively. This implies a rise of about a year in the average age of women at first marriage. For the assumption of a further reduction in age at marriage, the factors employed differed from those based on female nuptiality of 1942–47 by the same amount as those of the 'later marriage' assumption, but in the opposite direction. The calculation is shown in Table XI.

43. In the projection of marriages these factors were applied only to age groups under 20 in 1947; to older age groups the factors derived from female nuptiality of 1942–47 were applied. The underlying assumption is that of a change in marriage habits between one generation and another, and the most convenient point at which to make the change-over seemed to be between the age group 20–24 in 1947—a large proportion of which had already married under 1942–47 nuptiality—and the age group 15–19, in which the proportion married was still very small.

[1] These estimates were provisional and have since been revised. As a result the figures given for 1947 in Table IX of the Summary of Demographic Statistics (p. 204) differ slightly from those given in Table X below.

TABLE X

Projection of marriages of spinsters under 45, Great Britain, 1947–62

Age Group	Estimated population of spinsters Great Britain 1947 (000s.)	Spinsters (per female birth) in life table population	Date of birth	Assumed or projected female births (000s.)	Col. (5) × quinquennial marriage factors (Table VII, Col. (5))							Diagonal Total	Period for which diagonal total yields the projected number of marriages (000s.)
					·0347	·3715	·2926	·0776	·0275	·0120	·0036		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
40–44	339	·0984	1902–7	3445							12	1537	1947–52
35–39	332	·1121	1907–12	2962						36	11	1435	1952–57
30–34	331	·1412	1912–17	2344					64	28	8	1410	1957–62
25–29	457	·2209	1917–22	2069				161	57	25	7		
20–24	976	·5179	1922–27	1885			552	146	52	23	7		
15–19	1578	·8964	1927–32	1760		654	515	137	48	21	6		
10–14	1560	·9368	1932–37	1665	58	619	487	129	46	20	6		
5–9	1596	·9412	1937–42	1696	59	630	496	132	47	20	6		
0–4	1944	·9518	1942–47	2042	71	759	597	158	56	25	7		
			1947–52 etc.										

D. The Projection of Births from Marriages

44. The projection of births was performed by applying to the figure representing the marriages of each quinquennium a series of quinquennial fertility factors. One factor was required for the quinquennium in which the marriages took place, and one for each subsequent quinquennium in which the marriages could be expected to remain fertile. The factors were made slightly higher than would be appropriate for projecting the births to married couples, in order to allow for illegitimate births.

45. The first fertility assumption was based, as to its legitimate component, upon the net fertility of marriage of Great Britain, 1935–38, measured by the calculation described in Mr. Hajnal's report (Note IV). According to this calculation the average net fertility of first marriages of women under 45 in Great Britain 1935–38 was 2·000.

46. To this figure was added an allowance for illegitimate births, arrived at in the following way. The age-specific fertility rates of unmarried women in Great Britain 1938 were first applied to the estimated populations of unmarried women in 1947. The resulting total of births was expressed as a fraction of the legitimate births that *would* have occurred in 1947 if the net fertility of marriage in that year had been 2·000, as in 1935–38. This fraction was ·0335. The net fertility of marriage, 1935–38 was increased in this proportion and a figure of 2·067 was arrived at as the total of the required fertility factors.

47. The distribution of this total over the various quinquennia was obtained by a calculation employing a list of duration-specific fertility rates for England and Wales, 1939, calculated by Mr. Hajnal for use in another connection (see his Report on Births, Marriages and Reproductivity, England and Wales, 1938–47, Computational Note IV, Table B). These rates are for *calendar* durations, i.e., they each represent the average number of live births during the calendar year 1939 to cohorts of couples each consisting of those married in a particular calendar year. Table XII shows how from these annual rates may be derived a series of quinquennial factors.

48. The allocation of the fertility rates between quinquennia may be explained as follows. For the purposes of the projections, future time is divided into a series of quinquennia, 1947–52, 1952–57, etc. The third calendar year after marriage (taking the fertility rate of this year as an example) will be in the same quinquennium as the marriage (quinquennium 0) for marriages occurring in the first two calendar years of the quinquennium. For marriages occurring in the last three calendar years of the quinquennium the third calendar year will be in the next quinquennium after that in which the marriage occurred (quinquennium 1). On the assumption that marriages are evenly spread through the quinquennium, 2/5 of the fertility of the third calendar year after marriage may therefore be allocated to quinquennium 0 and 3/5 to quinquennium 1.

49. The figure of 2·067 arrived at above (para. 3) as the total of the fertility factors required for projection purposes was allocated between quinquennia in the same proportions as the total of the factors in Table XII (1·891). In fact, it is not plausible to assume the distribution of the total of 2·067 (which includes an allowance for illegitimate births as well as being derived from a different area and period from the rates totalling 1·891) to be exactly similar to that of the 1·891; but the difference in results made by any reasonable

TABLE XI

Calculation of projection factors implying (a) later marriage (b) earlier marriage, than implied by nuptiality of 1942–47

Age Group (1)	First marriages (per female birth) in passage from each age group to the next according to gross nuptiality of England and Wales 1938 (2)	First marriages (per female birth) in passage from each age group to the next according to gross nuptiality of England and Wales 1942–47 (3)	Column (2) adjusted so as to yield same proportion married at age 45 as gross nuptiality of England and Wales 1942–47 (4)	Col. (4) ÷ Col. (3) (ratio of marriages under 1938 distribution of marriages by age to those under 1942–47 distribution by marriage age) (5)	Factors for projecting marriages under nuptiality of Great Britain 1942–47 (6)	Col. (5) × Col. (6) (Factors for projecting marriage implying marriage age as 1938) (7)	Col. (6) —Col. (7) (8)	Col. (6) + Col. (8) (Factors for projecting marriages implying earlier marriage) (9)
10–14	·0292	0368	·0295	8016	0347	0278	·0069	0416
15–19	·3203	·4101	·3231	7879	3715	·2927	0788	4503
20–24	3607	·3177	·3639	1·1454	·2926	3351	—·0425	2501
25–29	·1242	·0853	·1253	1·4689	·0776	·1140	—·0364	·0412
30–34	·0351	·0303	·0354	1·1683	·0275	·0321	— 0046	0229
35–39	·0149	·0131	·0150	1·1450	·0120	·0137	— 0017	0103
40–44	·0074	·0066	·0075	1·1364	·0061	0041	— 0005	·0031

variation in the distribution would be trifling. The same proportionate distribution was in fact assumed throughout the series of fertility assumptions, each set of fertility factors being obtained by applying a given multiplier to each member of the original series.

50. An example of the projection of births with these factors is given in Table XIII, taken like Table X above from the working sheets of Projection 1. The marriages entered in column (2) represent from 1922–27 to 1942–47 the number of first marriages of women under 45 actually recorded. For 1947–52 and subsequent quinquennia they represent the number of marriages projected as in Table X above. The fertility factors are those derived from the net fertility of marriage, Great Britain, 1935–38. As in Table X the diagonal line unites events in a particular chronological period, and the diagonal total gives the projected total births for various future periods, columns (11) and (12) making the division between male and female births. The table can be extended by interaction with Table X as described in para. 39.

TABLE XII

Derivation of quinquennial fertility factors from annual fertility rates of England and Wales, 1939

Duration (difference between year of marriage and birth)	1939 rates of births per 1,000 marriages of spinsters under 45	Allocation of fertility rate between successive quinquennia, the difference (in quinquennia) between the calendar quinquennium of marriage and that of birth being:—					
		0	1	2	3	4	5
0	116	116					
1	280	224	56				
2	212	127	85				
3	181	72	109				
4	157	31	126				
5	137		137				
6	120		96	24			
7	104		62	42			
8	89		36	53			
9	78		16	62			
10	68			68			
11	61			49	12		
12	52			31	21		
13	45			18	27		
14	37			7	30		
15	32				32		
16	27				22	5	
17	23				14	9	
18	19				8	11	
19	15				3	12	
20	12					12	
21	9					7	2
22	7					4	3
23	4					2	2
24	2						2
25	2						2
26	1						1
27	1						1
Total ...	1,891	570	723	354	169	62	13

TABLE XIII

Projection of births (from Projection 1)

Date of marriage (mid-year to mid-year)	Marriages (of spinsters under 45) (000s.)	Quinquennial fertility factors						Diagonal total	Period whose projected births are given by Col. (9) (000s.)	Col. (9) × ·5124 (Projected male births) (000s.)	Col. (9) × ·4876 (Projected female births) (000s.)
		·623	·790	·387	·185	·068	014				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1922–27	1,492	—	—	—	—	—	21	3,636	1947–52	1,863	1,773
1927–32	1,590	—	—	—	—	108	22	3,329	1952–57	1,706	1,623
1932–37	1,753	—	—	—	324	119	25	3,104	1957–62	1,590	1,514
1937–42	2,136	—	—	827	395	145	30	—	—	—	—
1942–47	1,770	—	1,398	685	327	120	25	—	—	—	—
1947–52	1,537	958	1,214	595	284	105	22	—	—	—	—
1952–57	1,435	894	1,134	555	265	98	20	—	—	—	—
1957–62	1,410	878	1,114	546	261	96	20	—	—	—	—

51. The projected figures for births in 1947–52 given in columns (9), (11) and (12) of Table XIII above were not, in fact, employed in the projection, another and larger set of figures being substituted for them. The reason for this was that although, when the projections were constructed, the base date of mid-1947 was the latest for which a population estimate existed, the births were known for a considerable period subsequent to that date and could be forecast (from applications for the special ration books for expectant mothers) a little further ahead. Over this period births were occurring at a rate considerably higher than could plausibly be considered consistent with a total of 3,636,000 over the whole quinquennium mid-1947 to mid-1952. It seemed desirable to take this knowledge into account. It was therefore assumed that though for the later part of the quinquennium the rate at which births occur would conform to the projection, in the earlier years an 'excess' of births totalling 350,000 would occur. In this way a separate figure of 3,986,000 births was arrived at for this quinquennium. The births projected for 1947–52 on other assumptions were also corrected in this way (the size of the adjustment varying slightly from one projection to another), except in the case of Projection 9 where the projected births for 1947–52 showed no deficiency when compared with the known figures for the early part of the period.

52. As described in paras. 13 and 14 above, the second fertility assumption employs fertility factors 5 per cent. higher than those derived from the fertility of 1935–38, and the third (' exact replacement ') employs factors 6·34 per cent. higher than those of the second. The way in which the multiplier 1·0634 was arrived at is described in para. 57 below. Under the fourth assumption, ' falling fertility ', the fertility factors applied to the marriages which took place before 1947 were those of Assumption 2 (' 5 per cent. above 1935–38 '); those applied to the marriages of 1947–52, 1952–57 and 1957–62 were respectively 5 per cent., 10 per cent. and 15 per cent. below those of Assumption 2; those applied to the marriages of 1962–67 and subsequent quinquennia were uniformly 20 per cent. below those of Assumption 2. The fifth assumption, ' rising fertility ', is exactly converse to the fourth. The fertility factors at which stability is eventually reached under the fourth and fifth assumption are set out, together with the constant factors of Assumptions 1–3, in Table XIV.

TABLE XIV

Alternative series of fertility factors

Quinquennium (interval between period of marriage and period of births) (1)	Assumption 1 ' Fertility of 1935–38 ' (2)	Assumption 2 ' 5 per cent above 1935–38 ' (3)	Assumption 3 ' Exact replacement ' (Col (3) × 1 0634) (4)	Assumption 4 ' Falling fertility ' (ultimate level) (5)	Assumption 5 ' Rising fertility ' (ultimate level) (6)
0	·623	·654	·695	·523	785
1	·790	·830	·883	·664	996
2	·387	·406	·432	·325	·487
3	·185	·194	·206	·155	·233
4	·068	·071	·076	·057	·085
5	014	·015	·016	·012	·018
Total ...	2·067	2 170	2·308	1·736	2·604

E. Projection of Births under declining Mortality

53. The above account of the projection of births from marriages applies without modification only to the projections which assume constant mortality. A change in the mortality assumption must affect the number of projected births, since under, e.g., lower mortality the number of marriages to a given generation would be higher, and also the average number of births per marriage would be higher, since fewer marriages would be dissolved by death. To minimise the complexity of the calculation, the effect of the change in the mortality assumption was expressed in an adjustment which could be applied directly to modify the number of births projected, without changing the earlier stages of the calculation.

54. The first step was to calculate the proportion of each quinquennial age group of females in 1947, and of each quinquennial cohort of births after 1947, who would survive to subsequent dates 1952, 1957, etc., under the ' declining mortality ' assumption (this is readily done by cumulative multiplication of the ' group survival factors ' shown in Table IV). This proportion was divided by the analogous proportion derived from the 1942–44 mortality table, producing for each age-group at each date a ' Survivorship Modification Factor '. These were averaged for successive pairs of dates, 1947–52, 1952–57, etc., so as to obtain a survivorship modification factor applicable to the average population over the intervening quinquennial periods. For each quinquennial period a weighted average of the survivorship modification factors for the female age groups between 15 and 45 was obtained, the weights being proportional to the fertility rate of the age group in the net fertility table for England and Wales, 1938. The resulting ' Births Modification Factor ' was then applied to the births as projected by using the marriage and fertility factors appropriate to constant 1942–44 mortality.[1]

55. An example of these calculations is given in Table XV, relating to the period 1967–72. The figures in column (3) were obtained by cumulative multiplication of the figures given in Table IV above; thus, e.g., the figure for the age group 40–44 in 1967 was obtained by multiplying together the quinquennial group survival factors relevant to the group aged 20–24 in 1947 (·98933), 25–29 in 1952 (·99010), 30–34 in 1957 (·99044) and 35–39 in 1962 (·98980). The calculation of the survivorship modification factors for 1972 (Col. (5)) is not shown in the Table: it is analogous to the calculation of the 1967 factors. The net fertility rates in column (7) were taken from the *Registrar General's Statistical Review for England and Wales* 1938, *Part II (Civil)*, page 153. The births modification factor for 1967–72 ultimately arrived at is 1·0103, and this factor was applied to the births projected by means of the marriage and fertility factors appropriate to constant 1942–44 mortality.

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(1) This should not be read as implying that the 'Births Modification Factors' were simply applied throughout to a series of projected births taken from a ' constant mortality ' projection. Since projected future births are changed by the assumption of a decline in mortality, there has to be a fresh calculation of the future marriages resulting from these births and then of births arising from these marriages. These calculations are made with the same factors as are used in the ' constant mortality ' projections, except that the births so projected are finally multiplied by the births modification factor.

TABLE XV

Calculation of 'Births Modification Factor' for 1967–72

Age group (1)	Proportion of females surviving from 1947, or from birth, to this age-group in 1967 under constant 1942–44 mortality (2)	Proportion surviving from 1947 or from birth to this age-group in 1967 under 'declining mortality' (3)	Col (3) ÷ Col. (2) (Survivorship modification factor for 1967) (4)	Survivorship modification factor for 1972 (5)	Mean of (4) and (5) (Survivorship modification factor for 1967–72) (6)	Net fertility rate of age-group, England and Wales 1938 (7)	Col. (7) as a proportion of total of Col. (7) (8)	Col. (6) × Col (8) (9)
15–19	93100	·94469	1·01470	1 02066	1·01768	00650	040	0411
20–24.	·96854	97484	1·00650	1·01721	1·01186	·04096	·254	2575
25–29... ...	·96802	·97385	1·00602	1·00996	1·00799	·04974	·309	·3115
30–34... ...	·96097	·96822	1·00754	1·01029	1·00892	03602	224	2258
35–39.	·95454	·96353	1·00942	1·01244	1·01093	·02026	·126	·1273
40–44 . .	·94893	·96028	1·01196	1·01607	1 01402	·00749	047	·0471
Total ...						16097	1·000	1 0103

56. Table XVI gives the ‘ Births Modification Factor ’ for each quinquennium from 1947–52 to 2047–52. It will be observed that the factor grows steadily until 2022–27 after which it remains constant at 1·0496. This ultimate stability is due to the assumption that on the ‘ declining mortality ’ basis the decline ceases after 1977. In 2022 it would be true of every age group under 45 that their whole lives had been spent under the ‘ ultimate ’ mortality, and there would be no further improvement in ‘ survivorship ’ thereafter.

TABLE XVI

Births Modification Factors, 1947–2047

Period	Births Modification Factor
1947–52	1·0005
1952–57	1·0021
1957–62	1 0036
1962–67	1·0061
1967–72	1·0103
1972–77	1 0164
1977–82	1·0235
1982–87	1 0303
1987–92	1·0361
1992–97	1 0407
1997–2002	1·0443
2002–07	1·0470
2007–12	1·0485
2012–17	1·0493
2017–22	1·0495
2022–27	1·0496
2027–32	1·0496
2032–37	1·0496
2037–42	1·0496
2042–47	1·0496

57. It is now possible to describe the calculation of the fertility factors of the ‘ Exact Replacement ’ assumption. First, a calculation was made of the number of live births to a generation conforming to the ‘ intermediate ’ nuptiality of 1942–47, fertility 5 per cent. above that of 1935–38, and mortality at the 1942–44 rates. In such a generation there would be ·4129 ‘ female equivalent ’ marriages per original birth; to each marriage may be attributed 2·170 live births (Table XIV; this includes an allowance for illegitimate births). The product of ·4129 and 2·170 is ·8960, and this measures the extent of replacement inherent in the assumed conditions of marriage fertility and mortality; it is in fact a reproduction rate. Under ‘ declining mortality ’, the reproduction rate implied by the same marriage and fertility conditions would gradually rise as mortality fell. Ultimately stability would be reached, and the level at which it would be reached may be calculated by applying to the rate of ·8960 given above the ultimate ‘ Births Modification Factor ’ of 1·0496. This yields a reproduction rate of ·9404. Therefore to obtain ‘ exact replacement ’ in the long run under the stated conditions as regards marriage and mortality, the level of fertility required would be higher than that assumed above in the ratio of 1 to ·9404, i.e. 1·0634. This factor was accordingly applied to the fertility factors of Assumption 2 (‘ 5 per cent. above 1935–38 ’) to obtain the factors for the ‘ Exact Replacement ’ assumption.

F. Migration

58. As explained in the text, the migrants were regarded as a separate population, fed by a constant supply of persons of the age and sex distribution of the supposed net migration, and subject also, of course, to increase by births and to decrease by deaths. Given the appropriate factors the resulting

population can be calculated for each future date, and can be scaled up and down so as to show the effect on the future trend of population of migration on any scale which it is desired to assume.

59. Table XVII shows the assumed age and sex distribution of the migrants (the same for emigrants and immigrants), which was derived from that of the emigrants from Great Britain in the period 1921–32. The age-grouping of the migration statistics is not in the exact form required for the projection, and a distribution by quinquennial age groups was obtained by interpolation.

TABLE XVII

Age and sex distribution of migrants from Great Britain, 1921–32, with interpolated distribution by quinquennial age groups

Age Group	Number of emigrants from Great Britain 1921–32 (inclusive)		Age Group	Interpolated distribution per 50,000 migrants	
	Males	Females		Males	Females
Under 12	134,912	130,990	0– 4	1,640	1,520
12–17	85,766	53,677	5– 9	1,640	1,520
18–20	81 575	56,964	10–14	1,920	1,590
21–25	191,543	124,142	15–19	2,850	1,900
26–30	137,519	128,233	20–24	5,290	3,460
31–45	194,932	204,012	25–29	4,360	3,740
46 and over	81,735	101,130	30–34	2,930	3,000
Not stated	1,556	1,593	35–39	2,000	2,040
			40–44	1,330	1,400
Total	909,538	800,741	45–49	850	1,010
			50–54	670	820
			55–59	560	730
			60–64	430	510
			65–69	130	160
			Total	26,600	23,400

60. In the projection of the migrant population, 'declining mortality' was assumed, while the fertility factors used were quinquennial age-specific rates applicable to the mean population of men and women together. They were calculated so as to imply the same number of births to a generation as the assumptions of 'intermediate' 1942–47 nuptiality and fertility '5 per cent. above 1935–38'; i.e. in combination with 1942–44 mortality, they yield a reproduction rate of ·896 (see para. 57). The fertility and mortality assumed to obtain among the migrants are thus substantially identical with those of Projection 8. The relation between the rates of different age groups was derived from that of the joint age-specific fertility rates of England and Wales, 1938. Table XVIII sets out the age-specific fertility rates used in constructing the migrant populations.

TABLE XVIII

Quinquennial age-specific fertility rates used in calculating 'migrant' populations

Age group	Quinquennial births per person (male or female)
15–19	·0215
20–24	·1820
25–29	·2875
30–34	·2455
35–39	·1575
40–44	0770
45–49	·0270
50–54	·0075

61. The migrant populations calculated on these assumptions are set out fully in Tables XIX, XX and XXI below. These tables assume a flow of 50,000 migrants a year. Projections 12 and 14, which assume respectively a net emigration of 100,000 and 50,000 a year, were obtained by deducting from the figures of Projection 8 populations respectively twice the size of, and the same size as, the populations given below. Conversely, Projections 13 and 15, which assume a net immigration of 100,000 and 50,000 respectively, were obtained by adding similar populations to Projection 8.

TABLE XIX

'Migrant Populations', assuming 50,000 migrants annually: Summary Table

Thousands

Year	Total	Age 0–14	Age 15–64	Age 65 and over	Age 15–39	Age 40–64
1952	264	56	205	3	156	49
57	550	126	414	10	301	113
62	869	208	638	23	431	207
67	1,194	291	865	38	534	331
72	1,533	364	1,113	56	640	473
77	1,886	430	1,370	86	754	616
82	2,245	494	1,624	127	873	751
87	2,614	562	1,867	185	998	869
92	2,980	631	2,089	260	1,122	967
97	3,343	704	2,301	338	1,235	1,066
2002	3,700	773	2,518	409	1,345	1,173
07	4,046	839	2,738	469	1,453	1,285
12	4,391	904	2,966	521	1,566	1,400
17	4,729	970	3,192	567	1,678	1,514
22	5,064	1,034	3,409	621	1,791	1,618
27	5,407	1,100	3,624	683	1,902	1,722
32	5,740	1,165	3,832	743	2,010	1,822
37	6,073	1,229	4,042	802	2,115	1,927
42	6,401	1,291	4,254	856	2,223	2,031
47	6,729	1,355	4,466	908	2,329	2,137

62. Strictly speaking it is only Projection 8 with which the migrant populations can be combined in this way. To combine them with any other projection would be to assume an arbitrary difference in fertility or in mortality between the migrants and the main population. The error so introduced is not, however, very large for a moderate flow of emigration unless a very long period of future time is supposed to elapse. It was therefore thought worth while to combine immigrant populations on the scale appropriate to 100,000 immigrants a year with Projection 10 so as to show how far the consequences of falling family size for the trend of population could be averted by means of immigration. The result of this operation was Projection 16.

TABLE XX

Migrant populations, assuming 50,000 migrants annually: males in quinquennial age-groups

Thousands

Year	0–	5–	10–	15–	20–	25–	30–	35–	40–	45–	50–	55–	60–	65–	70–	75–	80–	85–	90–	95–	100–	Total
1952	12	8	9	12	20	24	18	12	8	5	4	3	2	1	—	—	—	—	—	—	—	138
57	28	20	17	21	32	44	42	30	20	13	9	6	5	3	1	—	—	—	—	—	—	291
62	42	36	29	29	41	56	62	54	38	25	17	11	8	6	3	1	—	—	—	—	—	458
67	55	50	44	40	49	64	73	73	61	43	28	19	13	8	5	2	—	—	—	—	—	627
72	65	62	59	56	60	72	82	85	81	65	45	30	19	12	7	3	1	—	—	—	—	804
77	76	73	71	70	76	84	90	94	92	85	67	46	30	18	10	5	2	—	—	—	—	989
82	87	84	82	82	90	99	101	102	101	96	86	67	44	27	15	7	3	1	—	—	—	1,174
87	100	95	92	93	102	113	117	113	109	105	97	85	64	40	22	10	4	1	—	—	—	1,362
92	112	107	104	104	113	125	131	128	120	112	105	95	81	58	33	15	6	2	—	—	—	1,551
97	124	120	116	115	123	136	143	142	135	123	113	103	90	72	47	23	8	2	1	—	—	1,736
2002	135	132	128	127	134	146	153	154	149	138	124	110	98	80	58	32	12	3	1	—	—	1,914
07	146	143	140	139	146	157	163	164	160	152	138	121	104	87	65	40	17	5	1	—	—	2,088
12	157	154	151	151	159	169	174	174	171	163	151	134	114	93	71	45	22	7	2	—	—	2,262
17	169	165	162	162	170	181	186	185	181	173	162	147	126	101	75	49	24	9	2	—	—	2,429
22	180	176	173	173	181	193	198	197	192	183	172	157	138	112	82	52	26	10	3	—	—	2,598
27	191	187	184	184	192	204	210	209	203	194	182	167	148	122	91	56	28	11	3	1	—	2,767
32	202	198	195	195	203	214	221	221	215	205	192	176	156	131	99	62	30	12	3	1	—	2,931
37	213	209	206	206	214	225	231	231	226	217	203	186	165	138	106	68	34	13	4	1	—	3,096
42	223	219	217	217	225	236	242	242	237	228	214	196	174	146	112	73	37	14	4	1	—	3,257
47	234	230	228	228	236	247	253	252	248	239	225	207	183	154	118	77	39	15	4	1	—	3,418

TABLE XXI

Migrant populations, assuming 50,000 migrants annually: females in quinquennial age-groups

Thousands

Year	0–	5–	10–	15–	20–	25–	30–	35–	40–	45–	50–	55–	60–	65–	70–	75–	80–	85–	90–	95–	100–	Total
1952	11	8	8	9	13	18	17	13	9	6	5	4	3	2	—	—	—	—	—	—	—	126
57	27	19	15	16	22	31	34	29	21	14	10	8	7	4	2	—	—	—	—	—	—	259
62	40	34	27	24	30	40	48	47	37	27	19	14	11	8	4	1	—	—	—	—	—	411
67	52	48	42	35	37	47	56	60	55	43	31	22	16	12	7	3	1	—	—	—	—	567
72	63	60	55	50	48	55	64	68	68	60	47	34	24	16	10	5	2	—	—	—	—	729
77	73	70	67	64	63	66	71	76	76	73	63	49	35	24	15	8	3	1	—	—	—	897
82	84	80	77	76	77	81	82	83	84	81	76	66	50	34	21	12	5	2	—	—	—	1,071
87	96	91	88	86	89	94	97	94	91	89	85	78	66	48	31	17	8	3	1	—	—	1,252
92	107	103	98	96	99	106	111	109	102	96	92	86	78	63	43	24	11	4	1	—	—	1,429
97	119	115	110	107	109	116	122	122	117	107	99	93	86	74	56	33	16	5	1	—	—	1,607
2002	130	126	122	119	120	126	132	134	130	121	110	100	93	81	66	44	22	8	2	—	—	1,786
07	140	137	133	130	131	137	142	144	141	135	124	111	99	88	72	51	29	11	3	—	—	1,958
12	151	147	144	142	143	148	153	153	151	146	137	124	109	94	78	56	34	14	4	1	—	2,129
17	161	158	155	152	154	160	164	161	161	156	148	137	123	103	83	61	37	17	5	1	—	2,300
22	172	168	165	163	165	171	175	175	171	165	157	148	135	115	91	65	40	18	6	1	—	2,466
27	183	179	176	173	175	181	187	187	183	176	167	157	145	127	102	71	43	20	7	1	—	2,640
32	193	190	187	184	185	192	197	198	194	187	177	166	154	136	112	80	47	21	7	2	—	2,809
37	204	200	197	195	196	202	207	208	205	198	188	176	163	145	120	87	53	23	8	2	—	2,977
42	214	210	208	205	207	213	218	218	215	209	199	187	172	153	127	94	58	26	9	2	—	3,144
47	224	221	218	216	217	223	228	229	225	219	210	198	183	162	135	100	62	29	10	2	—	3,311

IV. THE PROJECTIONS

This section falls into two parts. The first contains a summary of the chief results, so arranged as to facilitate the comparison of one projection with another. Thus the first summary table contains the total population as given by each of the 16 projections at quinquennial intervals from 1947 to 2047. There follow similar tables for the population of working age (15–64), of children under 15, and other important age-groups; for certain important proportions of one of these age-groups to the total, or to another; for the sex-ratio; and for projected births, deaths and marriages.

The second part gives projection by projection the full details of future populations by quinquennial age groups for each sex separately, as well as combined, at quinquennial intervals from 1947 to 2047. For convenience of reference the index of the projections showing the assumptions given in Table I is repeated in Table XXII.

TABLE XXII

Index of Projections showing Assumptions

Projection No.	Mortality	Marriage	Fertility	Net Migration
1	" Constant "	" Female 1942–47 "	" 1935–38 "	Nil
2	" Constant "	" Male 1942–47 "	" 1935–38 "	Nil
3	" Constant "	" Intermediate 1942–47 "	" 1935–38 "	Nil
4	" Constant "	" Later "	" 1935–38 "	Nil
5	" Constant "	" Earlier "	" 1935–38 "	Nil
6	" Constant "	" Intermediate 1942–47 "	" 5% above 1935–38"	Nil
7	" Declining "	" Intermediate 1942–47 "	" 1935–38 "	Nil
8	" Declining "	" Intermediate 1942–47 "	" 5% above 1935–38"	Nil
9	" Declining "	" Intermediate 1942–47 "	" Exact Replacement"	Nil
10	" Declining "	" Intermediate 1942–47 "	" Falling "	Nil
11	" Declining "	" Intermediate 1942–47 "	" Rising "	Nil
12	" Declining "	" Intermediate 1942–47 "	"5% above 1935–38 "	" 100,000 out"
13	" Declining "	" Intermediate 1942–47 "	"5% above 1935–38 "	" 100,000 in "
14	" Declining "	" Intermediate 1942–47 "	"5% above 1935–38 "	" 50,000 out"
15	" Declining "	" Intermediate 1942–47 "	"5% above 1935–38 "	" 50,000 in "
16	" Declining "	" Intermediate 1942–47 "	" Falling "	" 100,000 in "

A. *Summary Tables*

LIST OF TABLES

SUMMARY TABLE I

Total Population, 1947–2047

Thousands

Year	Projection															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1947	48,188	48,188	48,188	48,188	48,188	48,188	48,188	48,188	48,188	48,188	48,188	48,188	48,188	48,188	48,188	48,188
52	49,101	49,155	49,129	49,012	49,189	49,131	49,296	49,298	49,370	49,297	49,299	48,768	49,828	49,034	49,562	49,827
57	49,187	49,357	49,272	48,944	49,425	49,434	49,704	49,869	50,157	49,713	50,025	48,762	50,976	49,319	50,419	50,820
62	48,884	49,207	49,047	48,528	49,234	49,358	49,842	50,159	50,650	49,718	50,600	48,430	51,888	49,290	51,028	51,447
67	48,391	48,850	48,624	47,957	48,821	49,081	49,852	50,319	51,010	49,432	51,206	47,931	52,707	49,125	51,513	51,820
72	47,848	48,436	48,149	47,353	48,347	48,753	49,868	50,488	51,396	49,025	51,951	47,417	53,559	48,955	52,021	52,096
77	47,182	47,980	47,591	46,644	47,729	48,360	49,856	50,652	51,812	48,531	52,773	46,882	54,422	48,766	52,538	52,301
82	46,297	47,401	46,864	45,729	46,887	47,826	49,697	50,699	52,168	47,868	53,530	46,210	55,188	48,454	52,944	52,357
87	45,201	46,658	45,946	44,587	45,838	47,129	49,241	50,481	52,291	46,890	54,072	45,259	55,703	47,867	53,095	52,112
92	44,003	45,794	44,921	43,336	44,692	46,335	48,599	50,095	52,275	45,674	54,516	44,138	56,052	47,115	53,075	51,632
97	42,799	44,904	43,875	42,084	43,536	45,530	47,884	49,644	52,218	44,321	54,967	42,957	56,331	46,301	52,987	51,009
2002	41,649	44,071	42,887	40,897	42,420	44,793	47,186	49,232	52,217	42,924	55,540	41,835	56,629	45,532	52,932	50,320
07	40,530	43,301	41,949	39,758	41,315	44,114	46,532	48,870	52,299	41,514	56,226	40,774	56,966	44,824	52,916	49,610
12	39,406	42,575	41,032	38,631	40,197	43,464	45,892	48,544	52,435	40,103	56,985	39,764	57,324	44,153	52,935	48,883
17	38,254	41,837	40,088	37,483	39,041	42,792	45,222	48,194	52,571	38,644	57,744	38,736	57,652	43,465	52,923	48,101
22	37,060	41,046	39,096	36,303	37,837	42,061	44,486	47,781	52,649	37,104	58,458	37,647	57,915	42,717	52,845	47,238
27	35,844	40,207	38,069	35,121	36,596	41,286	43,682	47,293	52,652	35,487	59,099	36,483	58,103	41,886	52,700	46,297
32	34,668	39,385	37,066	33,982	35,374	40,525	42,864	46,787	52,622	33,871	59,703	35,304	58,270	41,047	52,527	45,354
37	33,546	38,613	36,123	32,924	34,190	39,800	42,104	46,307	52,611	32,325	60,289	34,163	58,451	40,234	52,380	44,469
42	32,496	37,900	35,239	31,935	33,078	39,126	41,401	45,878	52,636	30,898	60,858	33,078	58,678	39,477	52,279	43,698
2047	31,483	37,210	34,384	30,971	32,006	38,470	40,724	45,472	52,681	29,562	61,382	32,020	58,924	38,743	52,201	43,014

SUMMARY TABLE II

Population under 15 years of age, 1947–2047

Thousands

Year	Projection															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1947...	10,315	10,315	10,315	10,315	10,315	10,315	10,315	10,315	10,315	10,315	10,315	10,315	10,315	10,315	10,315	10,315
52..	10,911	10,965	10,939	10,822	10,999	10,941	10,983	10,985	11,057	10,984	10,986	10,873	11,097	10,929	11,041	11,096
57 ..	10,772	10,942	10,857	10,529	11,010	11,019	10,963	11,128	11,416	10,972	11,284	10,877	11,379	11,002	11,254	11,223
62...	9,746	10,069	9,909	9,390	10,096	10,220	10,086	10,403	10,894	9,962	10,844	9,988	10,818	10,195	10,611	10,377
67. .	8,880	9,287	9,086	8,534	9,224	9,541	9,313	9,778	10,398	8,892	10,664	9,196	10,360	9,487	10,069	9,474
72. .	8,700	9,122	8,918	8,442	8,966	9,363	9,207	9,664	10,290	8,355	10,973	8,936	10,392	9,300	10,028	9,083
77 ..	8,724	9,207	8,974	8,533	8,930	9,441	9,341	9,824	10,502	8,140	11,508	8,965	10,683	9,394	10,254	8,999
82...	8,655	9,316	8,997	8,509	8,828	9,515	9,452	9,997	10,784	8,039	11,955	9,010	10,984	9,503	10,491	9,026
87...	8,349	9,232	8,802	8,215	8,502	9,396	9,332	9,963	10,883	7,814	12,112	8,841	11,085	9,401	10,525	8,936
92...	7,933	8,949	8,453	7,783	8,090	9,119	9,036	9,750	10,790	7,417	12,083	8,487	11,013	9,119	10,381	8,680
97. .	7,589	8,623	8,114	7,422	7,758	8,839	8,744	9,520	10,654	6,979	12,061	8,113	10,927	8,816	10,224	8,386
2002...	7,370	8,386	7,887	7,202	7,532	8,651	8,564	9,389	10,602	6,608	12,170	7,844	10,934	8,616	10,162	8,153
07 ..	7,206	8,253	7,744	7,060	7,344	8,549	8,471	9,349	10,644	6,329	12,369	7,671	11,027	8,510	10,188	8,007
12 ..	7,015	8,171	7,610	6,902	7,125	8,463	8,389	9,326	10,717	6,096	12,556	7,519	11,133	8,422	10,230	7,903
17...	6,781	8,066	7,439	6 690	6,875	8,339	8,264	9,259	10,751	5,857	12,661	7,322	11,196	8,289	10,229	7,794
22...	6,529	7,910	7,231	6,444	6,625	8,170	8,096	9,146	10,736	5,597	12,695	7,076	11,216	8,112	10,180	7,667
27...	6,303	7,723	7,022	6,217	6,403	7,994	7,923	9,022	10,702	5,331	12,713	6,822	11,222	7,922	10,122	7,531
32 ..	6,109	7,545	6,831	6,023	6,204	7,843	7,772	8,917	10,682	5,079	12,755	6,586	11,248	7,752	10,082	7,410
37...	5,931	7,399	6,668	5,851	6,008	7,715	7,649	8,837	10,690	4,852	12,822	6,380	11,294	7,608	10,066	7,309
42...	5,751	7,272	6,515	5,685	5,810	7,597	7,529	8,768	10,709	4,646	12,890	6,184	11,352	7,477	10,059	7,230
2047...	5,567	7,148	6,358	5,509	5,613	7,475	7,406	8,693	10,721	4,446	12,940	5,986	11,400	7,338	10,048	7,153

SUMMARY TABLE III

Population between 15 and 40 years of age, 1947–2047

Thousands

Year	Projection 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1947	18,023	18,023	18,023	18,023	18,023	18,023	18,023	18,023	18,023	18,023	18,023	18,023	18,023	18,023	18,023	18,023
52	17,090	17,090	17,090	17,090	17,090	17,090	17,110	17,110	17,110	17,110	17,110	16,797	17,423	16,954	17,266	17,423
57	16,522	16,522	16,522	16,522	16,522	16,522	16,567	16,567	16,567	16,567	16,567	15,964	17,170	16,266	16,868	17,170
62	16,683	16,683	16,683	16,683	16,683	16,683	16,769	16,769	16,769	16,769	16,769	15,914	17,624	16,338	17,200	17,624
67	16,802	16,854	16,829	16,714	16,888	16,831	16,991	16,993	17,064	16,992	16,994	15,921	18,065	16,459	17,527	18,064
72	16,515	16,681	16,598	16,278	16,748	16,757	16,851	17,014	17,296	16,860	17,168	15,732	18,296	16,374	17,654	18,142
77	16,274	16,589	16,433	15,927	16,615	16,735	16,802	17,115	17,597	16,678	17,552	15,608	18,622	16,361	17,869	18,185
82	15,886	16,329	16,111	15,464	16,303	16,555	16,608	17,065	17,747	16,192	17,938	18,320	18,810	16,192	17,938	17,937
87	14,938	15,512	15,230	14,458	15,422	15,819	15,846	16,466	17,345	15,013	17,897	14,459	18,451	15,457	17,453	17,009
92	14,185	14,910	14,557	13,749	14,636	15,303	15,278	16,057	17,130	13,971	18,143	13,817	18,297	14,935	17,179	16,211
97	13,878	14,794	14,351	13,550	14,230	15,134	15,192	16,020	17,188	13,385	18,655	13,551	18,489	14,785	17,255	15,854
2002	13,606	14,721	14,180	13,340	13,900	15,040	15,139	16,059	17,369	12,951	19,167	13,371	18,747	14,714	17,404	15,639
07	13,264	14,584	13,940	13,017	13,535	14,892	15,013	16,037	17,524	12,539	19,535	13,128	18,946	14,584	17,490	15,448
12	12,828	14,300	13,566	12,555	13,055	14,618	14,734	15,875	17,541	12,037	19,713	12,742	19,008	14,309	17,441	15,170
17	12,299	13,920	13,128	12,051	12,553	14,274	14,374	15,627	17,460	11,446	19,808	12,266	18,988	13,949	17,305	14,807
22	11,874	13,559	12,736	11,628	12,112	13,965	14,055	15,404	17,387	10,869	19,939	11,819	18,989	13,613	17,195	14,454
27	11,522	13,286	12,424	11,300	11,737	13,726	13,816	15,254	17,381	10,360	20,148	11,449	19,059	13,352	17,156	14,165
32	11,196	13,078	12,157	11,001	11,386	13,526	13,620	15,149	17,425	9,924	20,374	11,130	19,168	13,139	17,159	13,943
37	10,851	12,877	11,887	10,689	11,022	13,321	13,419	15,037	17,468	9,516	20,558	10,806	19,268	12,922	17,152	13,747
42	10,492	12,648	11,590	10,349	10,650	13,091	13,189	14,893	17,479	9,110	20,676	10,450	19,336	12,670	17,116	13,553
2047	10,137	12,394	11,279	10,001	10,287	12,845	12,937	14,727	17,462	8,700	20,754	10,070	19,384	12,398	17,056	13,357

SUMMARY TABLE IV

Population between 15 and 65 years of age, 1947–2047

Thousands

Year	Projection 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1947	32,848	32,848	32,848	32,848	32,848	32,848	32,848	32,848	32,848	32,848	32,848	32,848	32,848	32,848	32,848	32,848
52	32,755	32,755	32,755	32,755	32,755	32,755	32,837	32,837	32,837	32,837	32,837	32,427	33,247	32,632	33,042	33,247
57	32,672	32,672	32,672	32,672	32,672	32,672	32,871	32,871	32,871	32,871	32,871	32,038	33,704	32,457	33,285	33,704
62 .. .	33,129	33,129	33,129	33,129	33,129	33,129	33,494	33,494	33,494	33,494	33,494	32,225	34,763	32,856	34,132	34,763
67	33,121	33,173	33,148	33,033	33,207	33,150	33,719	33,721	33,792	33,720	33,722	31,992	35,450	32,856	34,586	35,449
72	32,314	32,480	32,397	32,077	32,547	32,556	33,182	33,345	33,627	33,191	33,499	31,120	35,570	32,232	34,458	35,416
77	31,247	31,562	31,406	30,900	31,588	31,708	32,412	32,725	33,207	32,288	33,162	29,988	35,462	31,355	34,095	35,025
82	30,357	30,800	30,582	29,935	30,774	31,026	31,822	32,279	32,961	31,406	33,152	29,030	35,528	30,645	33,903	34,655
87	29,609	30,183	29,901	29,129	30,093	30,490	31,347	31,956	32,846	30,514	33,398	28,224	35,688	30,089	33,823	34,246
92	29,003	29,778	29,401	28,486	29,535	30,149	31,057	31,839	32,979	29,751	33,927	27,664	36,014	29,750	33,928	33,926
97	28,429	29,500	28,980	27,881	28,997	29,910	30,864	31,848	33,288	29,066	34,630	27,245	36,451	29 547	34,149	33,669
2002 . ..	27,881	29,287	28,602	27,297	28,490	29,744	30,732	31,953	33,725	28,426	35,480	26,920	36,986	29,435	34,471	33,459
07	27,127	28,851	28,008	26,501	27,774	29,368	30,373	31,833	33,967	27,497	36,169	26,354	37,312	29,095	34,571	32,976
12	25,858	27,871	26,889	25,196	26,539	28,468	29,403	31,118	33,618	25,907	36,329	25,183	37,053	28,152	34,084	31,842
17	24,756	27,021	25,915	24,134	25,394	27,718	28,556	30,531	33,363	24,384	36,678	24,145	36,917	27,339	33,723	30,770
22	24,072	26,575	25,355	23,543	24,612	27,277	28,168	30,291	33,362	23,280	37,302	23,470	37,112	26,882	33,700	30,101
27 . .	23,468	26,233	24,884	23,015	23,938	26,950	27,878	30,173	33,527	22,372	37,974	22,928	37,418	26,549	33,797	29,617
32	22,822	25,883	24,387	22,409	23,249	26,603	27,545	30,035	33,700	21,547	38,523	22,370	37,700	26,203	33,867	29,212
37	22,060	25,418	23,776	21,682	22,458	26,145	27,075	29,761	33,749	20,662	38,860	21,674	37,848	25,719	33,803	28,749
42	21,272	24,854	23,098	20,909	21,655	25,614	26,517	29,386	33,682	19,706	39,066	20,878	37,894	25,132	33,640	28,214
2047	20,553	24,294	22,453	20,203	20,913	25,104	25,974	29,020	33,603	18,763	39,277	20,087	37,953	24,554	33,486	27,696

Population over 65 years of age, 1947–2047

Thousands

Year	Projection															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1947	5,025	As Projection 1	As Projection 1	As Projection 1	As Projection 1	As Projection 1	5,025	As Projection 7	As Projection 7	As Projection 7	As Projection 7	5,025	5,025	5,025	5,025	5,025
52	5,435						5,476					5,468	5,484	5,473	5,479	5,484
57	5,743						5,870					5,847	5,893	5,860	5,880	5,893
62	6,009						6,262					6,217	6,307	6,239	6,285	6,307
67	6,390						6,820					6,743	6,897	6,782	6,858	6,897
72	6,834						7,479					7,361	7,597	7,423	7,535	7,597
77	7,211						8,103					7,929	8,277	8,017	8,189	8,277
82	7,285						8,423					8,170	8,676	8,296	8,550	8,676
87	7,243						8,562					8,194	8,930	8,377	8,747	8,930
92	7,067						8,506					7,987	9,025	8,246	8,766	9,026
97	6,781						8,276					7,599	8,953	7,938	8,614	8,954
2002	6,398						7,890					7,071	8,709	7,481	8,299	8,708
07	6,197						7,688					6,749	8,627	7,219	8,157	8,627
12	6,533	6,750	6,734	6,659	6,772	6,735	8,100	8,404	8,457	8,403	8,405	7,062	9,138	8,621	7,579	9,138
17	6,717	6,561	6,510	6,316	6,600	6,614	8,402	8,324	8,551	8,227	8,421	7,269	9,539	7,837	8,971	9,537
22	6,459	6,251	6,163	5,889	6,255	6,342	8,222	9,098	8,423	7,784	8,412	7,101	9,587	7,723	8,965	9,470
27	6,073	5,957	5,848	5,550	5,921	6,079	7,881	7,835	8,240	7,245	8,425	6,733	9,463	7,415	8,781	9,149
32	5,737	5,796	5,679	5,391	5,724	5,940	7,547	7,709	8,172	6,811	8,607	6,348	9,322	7,092	8,578	8,732
37	5,555	5,774	5,626	5,341	5,613	5,915	7,380	7,724	8,245	6,546	8,902	6,109	9,309	6,907	8,511	8,411
42	5,473	5,768	5,573	5,259	5,480	5,891	7,355	7,759	8,357	6,353	9,165	6,016	9,432	6,868	8,580	8,254
2047	5,363						7,344					5,947	9,571	6,851	8,667	8,165

SUMMARY TABLE VI

Proportion under 15 per 1,000 total population, 1947–2047

Thousands

Year	Projection															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1947...	214	214	214	215	214	214	214	214	214	214	214	214	214	214	214	214
52...	222	223	223	221	224	223	223	223	224	223	223	223	223	223	223	223
57...	219	222	220	215	223	223	221	223	228	221	226	223	223	223	223	221
62..	199	205	202	193	205	207	202	207	215	200	214	206	208	207	208	202
67...	184	190	187	178	189	194	187	194	204	180	208	192	197	193	195	183
72...	182	188	185	178	185	192	185	191	200	170	211	188	194	190	193	174
77.. .	185	192	189	183	187	195	187	194	203	168	218	191	196	193	195	172
82...	187	197	192	186	188	199	190	197	207	168	223	195	199	196	198	172
87...	185	198	192	184	185	199	190	197	208	167	224	195	199	196	198	171
92.. ...	180	195	188	180	181	197	186	195	206	162	222	192	196	194	196	168
97...	177	192	185	176	178	194	183	192	204	157	219	189	194	190	193	164
2002...	177	190	184	176	178	193	181	191	203	154	219	187	193	189	192	162
07...	178	191	185	178	178	194	182	191	204	152	220	188	194	190	193	161
12...	178	192	185	179	177	195	183	192	204	152	220	189	194	191	193	162
17...	177	193	186	178	176	195	183	192	204	152	219	189	194	191	193	162
22...	176	193	185	178	175	194	182	191	204	151	217	188	194	190	193	162
27..	176	192	184	177	175	194	181	191	203	150	215	187	193	189	192	163
32...	176	192	184	177	175	194	181	191	203	150	214	187	193	189	192	163
37..	177	192	185	178	176	194	182	191	203	150	213	187	193	189	192	164
42.	177	192	185	178	176	194	182	191	203	150	212	187	193	189	193	165
2047...	177	192	185	178	175	194	182	191	204	150	211	187	193	189	192	166

SUMMARY TABLE VII

Proportion aged 15–64 per 1,000 total population, 1947–2047

Thousands

Year	Projection															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1947	682	682	682	681	682	682	682	682	682	682	682	682	682	682	682	682
52	667	666	667	668	666	667	666	666	665	666	666	665	667	665	667	667
57	664	662	663	668	661	661	661	659	655	661	657	657	661	658	660	663
62	678	673	675	683	673	671	672	668	661	674	662	667	670	667	669	676
67	684	679	682	689	680	675	676	670	662	682	659	667	673	669	671	684
72	675	671	673	677	673	668	665	660	654	677	645	656	664	658	662	680
77	662	658	660	662	662	656	650	646	641	665	628	640	652	643	649	670
82	656	650	653	655	656	649	640	637	632	656	619	628	644	632	640	662
87	655	647	651	653	657	647	637	633	628	651	618	624	641	629	637	657
92	659	650	655	657	661	651	639	636	631	651	622	627	643	631	639	657
97	664	657	661	663	666	657	645	642	637	656	630	634	647	638	644	660
2002	669	665	667	667	672	664	651	649	646	662	639	643	653	646	651	665
07	669	666	668	667	672	666	653	651	649	662	643	646	655	649	653	665
12	656	655	655	652	660	655	641	641	641	646	638	633	646	638	644	651
17	647	646	646	644	650	648	631	634	635	631	635	623	640	629	637	640
22	650	647	649	649	650	649	633	634	634	627	638	623	641	629	638	637
27	655	652	654	655	654	653	638	638	637	630	643	628	644	634	641	640
32	658	657	658	659	657	656	643	642	640	636	645	634	647	638	645	644
37	658	658	658	659	657	657	643	643	641	639	645	631	648	639	645	646
42	655	656	655	655	655	655	640	641	641	638	642	631	646	637	643	646
2047	653	653	653	652	653	653	638	638	638	635	640	627	644	634	641	644

SUMMARY TABLE VIII

Proportion aged 65 and over per 1,000 total population, 1947–2047

Thousands

Year	Projection															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1947	104	104	104	105	104	104	104	104	104	104	104	104	104	104	104	104
52	111	111	111	111	110	111	111	111	111	111	111	112	110	112	111	110
57	117	116	117	117	116	116	118	118	117	118	117	120	116	119	117	116
62	123	122	123	124	122	122	126	125	124	126	124	128	122	127	123	123
67	132	131	131	133	131	130	137	136	134	138	133	141	131	138	133	133
72	143	141	142	144	141	140	150	148	146	153	144	155	142	152	145	146
77	153	150	152	155	151	149	163	160	156	167	154	169	152	164	156	158
82	157	154	155	159	155	152	169	166	161	176	157	177	157	171	161	166
87	160	155	158	162	158	154	174	170	164	183	158	181	160	175	165	171
92	161	154	157	163	158	153	175	170	163	186	156	181	161	175	165	175
97	158	151	155	161	156	149	173	167	158	187	151	177	159	171	163	176
2002	154	145	149	156	151	143	167	160	151	184	142	169	154	164	157	173
07	153	143	148	155	150	140	165	157	147	185	137	166	151	161	154	174
12	166	153	159	169	163	150	177	167	154	202	142	178	159	172	163	187
17	176	161	168	178	173	157	186	174	161	217	146	188	165	180	170	198
22	174	160	167	174	174	157	185	174	162	222	144	189	166	181	170	200
27	169	155	162	168	171	154	180	171	160	219	142	185	163	177	167	198
32	165	151	158	163	167	150	176	167	157	214	141	180	160	173	163	193
37	166	150	157	164	167	149	175	166	155	211	143	182	159	172	162	189
42	168	152	160	167	170	151	178	168	157	212	146	182	161	174	164	189
2047	170	155	162	170	171	153	180	171	159	215	149	186	163	177	166	190

SUMMARY TABLE IX

Proportion aged 15–39 per 1,000 aged 15–64, 1947–2047

Thousands

Year	Projection 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1947	549	549	549	549	549	549	549	549	549	549	549	549	549	549	549	549
52	522	522	522	522	522	522	521	521	521	521	521	518	524	520	523	524
57	506	506	506	506	506	506	504	504	504	504	504	498	509	501	507	509
62	504	504	504	504	504	504	501	501	501	501	501	494	507	497	504	507
67	507	508	508	506	509	508	504	504	505	504	504	498	510	501	507	510
72	511	514	512	507	515	515	508	510	514	508	512	506	514	508	512	512
77	521	526	523	515	526	528	518	523	530	517	529	520	525	522	524	519
82	523	530	527	517	530	534	522	529	538	516	541	528	529	528	529	518
87	505	514	509	496	512	519	506	515	528	492	536	512	517	514	516	497
92	489	501	495	483	496	508	492	504	519	470	535	499	508	502	506	478
97	488	501	495	486	491	506	492	503	516	461	539	497	507	500	505	471
2002	488	503	496	489	488	506	493	503	515	456	540	497	507	500	505	467
07	489	505	498	491	487	507	494	504	516	456	540	498	508	501	506	468
12	496	513	505	498	492	513	501	510	522	465	543	506	513	508	512	476
17	497	515	507	499	494	515	503	512	523	469	540	508	514	510	513	481
22	493	510	502	494	492	512	499	509	521	467	535	504	512	506	510	480
27	491	506	499	491	490	509	496	506	518	463	531	499	509	503	508	478
32	491	505	499	491	490	508	494	504	517	461	529	498	508	501	507	477
37	492	507	500	493	491	510	496	505	518	461	529	499	509	502	507	478
42	493	509	502	495	492	511	497	507	519	462	529	501	510	504	509	480
2047	493	510	502	495	492	512	498	507	520	464	528	501	511	505	509	482

SUMMARY TABLE X

Proportion of females (all ages) to males (all ages), 1947–2047

Thousands

Year	Projection 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1947	1·0678	1·0678	1·0678	1·0678	1·0678	1·0678	1·0678	1·0678	1·0678	1·0678	1·0678	1·0678	1·0678	1·0678	1·0678	1·0678
52	1·0652	1·0651	1·0652	1·0654	1·0650	1·0652	1·0650	1·0650	1·0648	1·0650	1·0651	1·0671	1·0629	1·0659	1·0641	1·0629
57	1·0631	1·0627	1·0629	1·0636	1·0626	1·0626	1·0627	1·0624	1·0618	1·0627	1·0621	1·0666	1·0584	1·0873	1·0604	1·0587
62	1·0599	1·0591	1·0595	1·0605	1·0591	1·0589	1·0598	1·0593	1·0583	1·0601	1·0584	1·0656	1·0533	1·0623	1·0563	1·0541
67	1·0561	1·0552	1·0556	1·0569	1·0554	1·0548	1·0562	1·0553	1·0540	1·0570	1·0536	1·0637	1·0477	1·0592	1·0515	1·0492
72	1·0520	1·0510	1·0515	1·0529	1·0512	1·0505	1·0522	1·0509	1·0494	1·0537	1·0483	1·0613	1·0419	1·0558	1·0464	1·0443
77	1·0450	1·0468	1·0476	1·0492	1·0473	1·0462	1·0486	1·0470	1·0451	1·0510	1·0434	1·0592	1·0367	1·0529	1·0417	1·0399
82	1·0422	1·0431	1·0441	1·0459	1·0440	1·0424	1·0458	1·0439	1·0416	1·0491	1·0393	1·0577	1·0325	1·0504	1·0380	1·0365
87	1·0402	1·0398	1·0410	1·0433	1·0411	1·0392	1·0428	1·0406	1·0378	1·0471	1·0351	1·0561	1·0282	1·0477	1·0343	1·0331
92	1·0379	1·0373	1·0386	1·0411	1·0390	1·0364	1·0394	1·0370	1·0338	1·0447	1·0305	1·0536	1·0240	1·0447	1·0301	1·0296
97	1·0360	1·0345	1·0362	1·0390	1·0367	1·0337	1·0364	1·0335	1·0299	1·0425	1·0263	1·0513	1·0201	1·0418	1·0263	1·0264
2002	1·0361	1·0324	1·0343	1·0371	1·0349	1·0315	1·0335	1·0304	1·0266	1·0409	1·0224	1·0489	1·0170	1·0388	1·0233	1·0241
07	1·0356	1·0314	1·0334	1·0366	1·0344	1·0305	1·0313	1·0281	1·0239	1·0400	1·0195	1·0475	1·0145	1·0367	1·0209	1·0223
12	1·0361	1·0314	1·0335	1·0367	1·0350	1·0303	1·0303	1·0266	1·0221	1·0402	1·0172	1·0465	1·0131	1·0355	1·0193	1·0217
17	1·0370	1·0319	1·0341	1·0372	1·0362	1·0307	1·0302	1·0264	1·0218	1·0421	1·0161	1·0472	1·0126	1·0355	1·0187	1·0223
22	1·0382	1·0325	1·0353	1·0385	1·0379	1·0316	1·0314	1·0273	1·0226	1·0446	1·0164	1·0492	1·0133	1·0370	1·0195	1·0236
27	1·0390	1·0332	1·0359	1·0390	1·0392	1·0324	1·0322	1·0281	1·0231	1·0468	1·0170	1·0511	1·0139	1·0380	1·0202	1·0244
32	1·0388	1·0328	1·0358	1·0383	1·0393	1·0320	1·0318	1·0278	1·0231	1·0472	1·0169	1·0515	1·0137	1·0379	1·0200	1·0239
37	1·0382	1·0323	1·0350	1·0378	1·0389	1·0315	1·0304	1·0267	1·0221	1·0456	1·0168	1·0508	1·0129	1·0370	1·0190	1·0221
42	1·0379	1·0321	1·0346	1·0375	1·0385	1·0311	1·0294	1·0260	1·0215	1·0441	1·0169	1·0507	1·0123	1·0362	1·0183	1·0202
2047	1·0383	1·0321	1·0349	1·0377	1·0386	1·0316	1·0294	1·0258	1·0212	1·0436	1·0174	1·0512	1·0123	1·0361	1·0183	1·0192

SUMMARY TABLE XI

Average annual births, 1947–2047

Thousands

Period	Projection 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1947–52	797·2	808·6	803·0	778·2	815·8	803·4	803·4	803·8	818·8	803·6	804·0	797·2	810·4	800·6	807·0	810·2
52–57	665·8	690·6	678·2	633·4	698·0	712·2	679·6	713·6	758·8	681·2	745·6	694·2	733·0	703·8	723·4	700·6
57–62	620·8	653·6	637·4	596·4	644·8	669·2	639·6	671·6	714·4	612·0	731·2	640·4	702·8	656·0	687·0	643·2
62–67	611·2	640·2	626·0	594·0	628·8	657·4	629·8	661·4	703·2	568·6	754·2	620·4	702·4	640·8	682·0	609·6
67–72	626·8	655·4	641·8	613·0	642·0	673·8	648·4	680·6	726·0	560·8	800·4	631·0	730·2	655·8	705·4	610·4
72–77	625·8	671·4	649·2	616·2	637·2	685·6	660·0	697·2	750·2	560·2	834·2	639·2	755·2	668·2	726·2	618·2
77–82	597·0	663·6	631·4	588·6	607·0	673·6	646·6	690·2	754·2	542·2	838·2	623·2	757·2	656·6	723·8	609·2
82–87	561·6	637·6	600·4	551·0	572·8	648·8	620·0	669·8	742·4	510·6	829·0	592·8	746·8	631·2	708·4	587·6
87–92	536·6	611·2	574·4	524·0	549·0	626·4	597·6	651·2	729·4	477·4	825·0	564·2	738·2	607·6	694·8	564·4
92–97	523·8	593·8	559·4	511·0	536·0	613·6	586·2	642·8	726·0	451·8	833·8	546·2	739·4	594·4	691·2	548·4
97–02	514·4	586·8	551·6	503·8	524·8	608·8	582·6	642·8	731·2	434·2	851·4	537·2	748·4	590·0	695·6	539·8
2002–07	501·6	582·8	543·6	493·8	508·6	604·4	578·6	643·0	738·4	419·8	866·2	528·6	757·4	585·8	700·2	534·2
07–12	483·2	576·4	530·8	477·2	489·4	595·2	569·4	638·0	740·8	403·4	872·6	514·6	761·4	576·4	699·6	526·8
12–17	464·2	564·4	515·2	458·4	471·0	582·0	556·8	629·2	738·6	385·0	873·4	496·8	761·6	563·0	695·4	517·4
17–22	448·0	549·6	499·4	441·8	455·6	568·6	543·8	619·4	735·0	366·2	872·6	477·8	761·0	548·6	690·2	507·8
22–27	434·8	536·4	485·8	428·4	441·8	557·8	533·8	612·2	733·8	348·4	876·0	461·8	762·6	537·0	687·4	498·8
27–32	422·6	526·4	474·8	416·8	428·2	549·6	525·8	607·6	734·8	333·2	882·0	448·4	766·8	528·0	687·2	492·4
32–37	410·2	518·2	464·4	405·2	413·8	541·2	518·0	603·2	736·6	319·2	887·2	435·4	771·0	519·2	687·2	487·0
37–42	396·4	509·2	453·0	392·8	399·4	532·8	509·2	598·0	737·6	306·0	890·0	421·6	774·4	509·8	686·2	482·4
42–47	383·2	500·0	441·6	379·4	386·2	523·0	500·2	592·0	737·2	292·0	892·0	407·0	777·0	499·6	684·4	477·0

SUMMARY TABLE XII

Average annual deaths, 1947–2047

Thousands

Period	Projection															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1947–52	614·6	615·2	614·8	613·4	615·6	614·8	581·8	581 8	582 4	581 8	581·8	581 2	582 4	581·4	582 2	582 4
52–57	648·6	650·2	649·6	647·0	650·8	651·6	598·0	599 4	601·4	598·0	600 8	595·4	603 4	596·8	602·0	602 0
57–62	681·4	683·6	682·4	679·6	683 0	684·4	612 0	613 6	615 8	611 0	616·2	606·8	620·4	611·8	615·2	617 8
62–67	709·8	711·6	710·6	708 2	711 4	712·8	627·8	629 4	631 2	625·8	633 0	620·2	638·6	623·8	635·0	635·0
67–72	735·4	738·2	736·8	733·8	736·8	739·4	645 2	646 8	648 8	642 2	651 4	633 8	659 8	639·8	653·8	655 2
72–77	759·0	762·6	760·8	758·0	760·8	764·2	662·4	664·4	667 0	659 0	669 8	646·2	682·6	656 0	672 8	677·2
77–82	774·0	779·4	776·8	771·6	775 4	780·4	678·4	680·8	683·0	674·8	686·8	657 6	704 0	669·0	692 6	698·0
82–87	780·8	766·2	784·0	779 4	782·6	788·2	711·2	713·4	717·8	706·2	720·6	683·0	743 8	698 6	728·2	736·6
87–92	776·2	784·0	779·4	774·2	778 2	785·2	726 0	728·4	732 6	720 6	736 2	688·4	768 2	708 0	748·8	760·4
92–97	764·6	771·8	768·6	761·4	767·2	774·6	729·2	733·0	737·4	722·4	743 6	702·4	783·6	707·2	758 8	773 0
97–02	744·4	753·4	749·2	741·2	748·0	756·2	722·2	725·2	731·4	713·6	736·8	661·6	788·8	693·8	756·6	777·6
2002–07	725·4	736·8	731·2	721·6	729·6	740·2	709·4	715 4	722·0	701·8	729·0	640 8	789 4	677·4	753·4	776 2
07–12	708·0	721·6	714·2	702 6	713 0	725·2	697·4	703 2	713 6	685·6	720 8	616·6	789 8	660 6	745·8	772 2
12–17	694·6	712·0	704·0	688 0	702 2	716·4	690·8	699·2	711·4	676·8	721·6	602 4	796·0	650·6	747·8	773·8
17–22	686·8	707·8	697·8	677 8	696 4	714·8	691·0	702·0	719·4	674·2	729·8	595·6	808·4	648·2	755·8	780·4
22–27	678·0	704 2	691·2	664·8	690·0	712·8	694·6	709·8	753·2	671·8	747·8	592 6	825·0	653·2	766·4	787·0
27–32	657·8	690·8	675·4	644·6	672·6	701·8	689·4	708·8	740·8	656·4	761·2	584·2	833·4	645·8	771·8	781·0
32–37	634·6	672·6	653·0	616·8	650·6	686·2	670·0	699·2	738·8	628·4	770·0	563·6	834·8	631·8	766 6	764·0
37–42	606·4	651·8	629·8	590·6	621·8	667·6	649·8	683·8	732·6	591·4	776·2	538·6	829·0	611 2	756·4	736·6
42–47	585·8	638·0	612·6	572·2	600·6	654·2	635·6	673·2	728·2	559·2	787·2	518·6	827·8	596·4	750·0	713·8

SUMMARY TABLE XIII

Average annual marriages of spinsters under 45,* 1947–2047

Thousands

Period	Projection 1	Projection 2†	Projection 3	Projection 4	Projection 5	Projection 6
1947–52 ..	307·4	320·6	314·0	277·2	337·4	314·0
52–57 ...	287·0	307·6	297 4	273·2	300·6	297·4
57–62 ...	282 0	299·6	290 8	279·4	284·6	290·8
62–67 ..	305·8	312·6	309 8	299·0	313·2	309·8
67–72 ...	316·2	334·8	325 8	311·8	322·2	326·2
72–77 ..	291·2	329·4	310·8	289·0	294·6	316·0
77–82 ...	264·4	306 8	286·4	259·0	269·8	296·4
82–87 ..	252 0	289·6	270 8	245·0	258·0	282·8
87–92 .	249·8	281 4	265 8	243·0	256·6	278·4
92–97 ...	249·6	281·8	266·2	244·4	255·0	279·8
97–02 ..	244 0	282 8	264·4	240·4	246·4	279·8
2002–07 ..	232 6	280 4	257·2	231·0	235·2	275·4
07–12 ...	221 8	272·8	247·6	219·4	224·8	267 2
12–17 ...	214 2	264·2	239·2	210·6	218 0	260 2
17–22 ..	208 8	257 2	233·0	205·0	212·4	255·0
22–27 ...	203·6	253 0	228·4	200 6	206·4	252 2
27–32 ...	197 6	249 6	224·0	195·4	199·2	249·2
32–37 ..	190·6	246 4	218·6	189·0	191·6	245·0
37–42 ..	183·8	241 2	212 6	182·6	185·2	240 2
42–47 ...	178 0	236 0	206·8	175·8	179·4	235·6

* The method of computation is such as to throw up figures of projected marriages only in projections assuming constant mortality (see para. 53). For this reason no figures are given for projections 7–16 inclusive.

† Number of " female equivalent ma

B Detailed Tables of each Projection

PROJECTION 1

(Assumptions: *Mortality* 'Constant', *Marriage-rates* 'Female 1942-47', *Fertility* '1935–38', *Net Migration Nil*)*

A. PERSONS IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	3,971	3,239	3,105	3,357	3,531	3,646	3,650	3,839	3,666	3,323	2,894	2,624	2,318	1,968	1,490	919	450	198	48,188
1952	3,768	3,922	3,221	3,083	3,321	3,488	3,599	3,599	3,769	3,571	3,196	2,729	2,400	2,019	1,585	1,052	525	254	49,101
1957	3,148	3,723	3,901	3,200	3,052	3,280	3,442	3,548	3,533	3,672	3,433	3,013	2,499	2,093	1,627	1,121	602	300	49,187
1962	2,935	3,109	3,702	3,875	3,165	3,013	3,236	3,394	3,483	3,442	3,529	3,236	2,756	2,178	1,687	1,152	643	349	48,884
1967	2,889	2,899	3,092	3,678	3,833	3,126	2,974	3,191	3,332	3,393	3,309	3,327	2,958	2,400	1,757	1,194	662	377	48,391
1972	2,963	2,854	2,883	3,072	3,639	3,785	3,086	2,933	3,133	3,245	3,263	3,118	3,040	2,574	1,933	1,245	686	396	47,848
1977	2,958	2,927	2,839	2,865	3,039	3,593	3,736	3,041	2,878	3,052	3,120	3,073	2,850	2,645	2,071	1,367	717	411	47,182
1982	2,822	2,922	2,911	2,820	2,834	3,001	3,547	3,684	2,986	2,804	2,933	2,939	2,809	2,480	2,129	1,463	786	427	46,297
1987	2,655	2,787	2,907	2,892	2,789	2,798	2,962	3,497	3,618	2,909	2,695	2,763	2,686	2,444	1,995	1,503	839	462	45,201
1992	2,537	2,623	2,773	2,887	2,861	2,755	2,762	2,920	3,432	3,524	2,797	2,540	2,525	2,338	1,965	1,409	861	494	44,003
1997	2,476	2,505	2,608	2,755	2,857	2,825	2,719	2,722	2,867	3,344	3,386	2,634	2,320	2,196	1,880	1,387	808	510	42,799
2002	2,432	2,446	2,492	2,591	2,725	2,820	2,789	2,681	2,673	2,793	3,213	3,189	2,407	2,018	1,766	1,326	795	493	41,649
2007	2,371	2,402	2,433	2,476	2,563	2,691	2,785	2,749	2,632	2,604	2,684	3,028	2,915	2,092	1,622	1,244	759	480	40,530
2012	2,284	2,342	2,389	2,417	2,449	2,531	2,656	2,745	2,700	2,563	2,503	2,528	2,766	2,533	1,682	1,144	712	462	39,406
2017	2,194	2,257	2,330	2,373	2,391	2,419	2,498	2,618	2,695	2,629	2,464	2,358	2,311	2,406	2,036	1,186	654	435	38,254
2022	2,117	2,167	2,245	2,315	2,348	2,360	2,387	2,464	2,571	2,625	2,527	2,321	2,154	2,009	1,934	1,435	679	402	37,060
2027	2,055	2,092	2,156	2,230	2,289	2,319	2,331	2,353	2,418	2,504	2,523	2,380	2,121	1,874	1,614	1,363	820	402	35,844
2032	1,997	2,031	2,081	2,142	2,206	2,261	2,289	2,298	2,311	2,356	2,407	2,377	2,175	1,844	1,506	1,139	780	468	34,668
2037	1,939	1,973	2,019	2,067	2,118	2,178	2,232	2,256	2,256	2,250	2,264	2,267	2,172	1,891	1,482	1,062	651	469	33,546
2042	1,873	1,915	1,963	2,006	2,045	2,092	2,149	2,200	2,215	2,197	2,164	2,133	2,071	1,889	1,520	1,045	608	411	32,496
2047	1,811	1,851	1,905	1,950	1,984	2,019	2,065	2,119	2,160	2,157	2,112	2,038	1,949	1,802	1,518	1,072	598	373	31,483

* For a fuller definition of the assumptions, see paras. 5–18 of the report above.

C. FEMALES IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	1,937	1,391	1,530	1,657	1,760	1,827	1,840	1,941	1,865	1,743	1,577	1,430	1,285	1,101	842	539	283	136	24,884
1952	1,850	1,915	1,584	1,520	1,640	1,740	1,805	1,817	1,910	1,824	1,689	1,507	1,334	1,150	917	622	328	174	25,326
1957	1,545	1,830	1,906	1,574	1,506	1,622	1,719	1,783	1,788	1,869	1,768	1,614	1,407	1,195	958	678	379	205	25,346
1962	1,441	1,528	1,821	1,894	1,558	1,488	1,601	1,697	1,754	1,750	1,811	1,690	1,507	1,259	995	708	412	239	25,153
1967	1,418	1,425	1,520	1,810	1,875	1,540	1,470	1,581	1,670	1,716	1,696	1,731	1,577	1,349	1,049	736	431	262	24,856
1972	1,454	1,402	1,418	1,511	1,792	1,853	1,522	1,452	1,556	1,634	1,664	1,620	1,615	1,412	1,123	775	448	279	24,530
1977	1,452	1,438	1,396	1,410	1,496	1,771	1,831	1,502	1,428	1,523	1,584	1,589	1,512	1,446	1,176	830	472	291	24,147
1982	1,385	1,436	1,431	1,387	1,396	1,479	1,750	1,808	1,478	1,398	1,476	1,513	1,483	1,354	1,205	869	506	304	23,658
1987	1,303	1,369	1,430	1,423	1,373	1,379	1,461	1,728	1,780	1,446	1,354	1,410	1,412	1,328	1,127	890	530	325	23,068
1992	1,245	1,289	1,363	1,421	1,409	1,358	1,363	1,442	1,700	1,742	1,403	1,295	1,316	1,265	1,106	834	542	342	22,435
1997	1,215	1,231	1,282	1,355	1,407	1,392	1,341	1,345	1,420	1,664	1,688	1,340	1,208	1,179	1,054	817	508	351	21,797
2002	1,194	1,202	1,225	1,275	1,341	1,390	1,376	1,324	1,324	1,389	1,612	1,612	1,251	1,082	982	778	498	339	21,194
2007	1,164	1,180	1,196	1,218	1,262	1,326	1,374	1,358	1,303	1,296	1,346	1,541	1,506	1,119	901	725	474	330	20,619
2012	1,121	1,151	1,175	1,189	1,206	1,247	1,310	1,356	1,337	1,275	1,256	1,286	1,438	1,347	933	666	442	317	20,052
2017	1,077	1,109	1,146	1,167	1,177	1,192	1,232	1,293	1,335	1,308	1,236	1,200	1,201	1,288	1,123	689	405	296	19,474
2022	1,039	1,065	1,104	1,139	1,156	1,163	1,177	1,217	1,273	1,306	1,267	1,181	1,120	1,075	1,073	829	420	273	18,877
2027	1,009	1,028	1,060	1,097	1,127	1,143	1,150	1,162	1,197	1,245	1,266	1,211	1,102	1,003	895	792	505	273	18,265
2032	980	998	1,023	1,054	1,086	1,114	1,129	1,135	1,144	1,172	1,207	1,210	1,130	987	835	662	483	315	17,664
2037	952	969	993	1,017	1,043	1,073	1,101	1,114	1,117	1,119	1,135	1,153	1,129	1,012	822	617	403	318	17,087
2042	919	941	965	987	1,007	1,031	1,060	1,087	1,097	1,093	1,085	1,085	1,076	1,011	843	607	376	280	16,550
2047	889	909	937	959	977	995	1,019	1,047	1,070	1,073	1,059	1,037	1,013	964	842	623	370	254	16,037

PROJECTION 2

(Assumptions: *Mortality 'Constant'; Marriage-rates 'Male 1942–47'; Fertility '1935–38'; Net Migration Nil*)*

A. PERSONS IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	3,971	3,239	3,105	3,357	3,531	3,646	3,650	3,839	3,666	3,323	2,894	2,624	2,318	1,968	1,490	919	450	198	48,188
1952	3,822	3,922	3,221	3,083	3,321	3,488	3,599	3,599	3,769	3,571	3,196	2,729	2,400	2,019	1,585	1,052	525	254	49,155
1957	3,265	3,776	3,901	3,200	3,052	3,280	3,442	3,548	3,533	3,672	3,433	3,013	2,499	2,093	1,627	1,121	602	300	49,357
1962	3,089	3,225	3,755	3,875	3,165	3,013	3,236	3,394	3,483	3,442	3,529	3,236	2,756	2,178	1,687	1,152	643	349	49,207
1967	3,027	3,052	3,208	3,730	3,833	3,126	2,974	3,191	3,332	3,393	3,309	3,327	2,958	2,400	1,757	1,194	662	377	48,850
1972	3,098	2,989	3,035	3,186	3,691	3,785	3,086	2,933	3,133	3,245	3,263	3,118	3,040	2,574	1,933	1,245	686	396	48,436
1977	3,174	3,060	2,973	3,015	3,152	3,645	3,736	3,041	2,878	3,052	3,120	3,073	2,850	2,645	2,071	1,367	717	411	47,980
1982	3,137	3,135	3,044	2,953	2,983	3,112	3,597	3,684	2,986	2,804	2,933	2,939	2,809	2,480	2,129	1,463	786	427	47,401
1987	3,014	3,099	3,119	3,024	2,922	2,946	3,073	3,547	3,618	2,909	2,695	2,763	2,686	2,444	1,995	1,503	839	462	46,658
1992	2,889	2,978	3,082	3,097	2,991	2,885	2,908	3,029	3,482	3,524	2,797	2,540	2,525	2,338	1,965	1,409	861	494	45,794
1997	2,807	2,854	2,962	3,061	3,064	2,954	2,848	2,867	2,974	3,392	3,386	2,634	2,320	2,196	1,880	1,387	808	510	44,904
2002	2,774	2,773	2,839	2,942	3,028	3,026	2,917	2,808	2,814	2,896	3,260	3,189	2,407	2,018	1,766	1,326	795	493	44,071
2007	2,756	2,740	2,757	2,820	2,910	2,991	2,988	2,875	2,756	2,741	2,784	3,071	2,915	2,092	1,622	1,244	759	480	43,301
2012	2,724	2,721	2,726	2,739	2,789	2,874	2,953	2,945	2,822	2,685	2,635	2,623	2,806	2,533	1,682	1,144	712	462	42,575
2017	2,668	2,691	2,707	2,707	2,710	2,755	2,837	2,911	2,891	2,749	2,581	2,483	2,397	2,439	2,036	1,186	654	435	41,837
2022	2,598	2,635	2,677	2,689	2,678	2,676	2,719	2,797	2,857	2,816	2,643	2,431	2,269	2,084	1,961	1,435	679	402	41,046
2027	2,536	2,566	2,621	2,659	2,660	2,645	2,641	2,681	2,745	2,784	2,707	2,490	2,221	1,972	1,675	1,382	820	402	40,207
2032	2,488	2,505	2,552	2,604	2,631	2,627	2,611	2,605	2,632	2,674	2,675	2,550	2,274	1,932	1,585	1,181	791	468	39,385
2037	2,450	2,458	2,491	2,536	2,576	2,598	2,593	2,574	2,557	2,563	2,571	2,520	2,330	1,977	1,553	1,117	676	473	38,613
2042	2,407	2,420	2,445	2,475	2,508	2,544	2,565	2,556	2,527	2,490	2,464	2,422	2,303	2,026	1,590	1,095	640	423	37,900
2047	2,363	2,378	2,407	2,428	2,449	2,477	2,511	2,529	2,510	2,462	2,394	2,321	2,213	2,003	1,628	1,120	627	390	37,210

* For a fuller definition of the assumptions, see paras. 5–18 of the report above.

B. MALES IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	2,034	1,648	1,575	1,700	1,771	1,819	1,810	1,898	1,801	1,580	1,317	1,194	1,033	867	648	380	167	62	23,304
1952	1,946	2,007	1,637	1,563	1,681	1,748	1,794	1,782	1,859	1,747	1,507	1,222	1,066	869	668	430	197	80	23,803
1957	1,662	1,921	1,995	1,626	1,546	1,658	1,723	1,765	1,745	1,803	1,665	1,399	1,092	898	669	443	223	95	23,928
1962	1,573	1,640	1,909	1,981	1,607	1,525	1,635	1,697	1,729	1,692	1,718	1,546	1,249	919	692	444	231	110	23,897
1967	1,541	1,553	1,630	1,895	1,958	1,586	1,504	1,610	1,662	1,677	1,613	1,596	1,381	1,051	708	458	231	115	23,769
1972	1,577	1,520	1,543	1,618	1,874	1,932	1,564	1,481	1,577	1,611	1,599	1,498	1,425	1,162	810	470	238	117	23,616
1977	1,616	1,556	1,511	1,532	1,600	1,849	1,905	1,539	1,450	1,529	1,536	1,484	1,338	1,199	895	537	245	120	23,441
1982	1,597	1,594	1,547	1,500	1,515	1,578	1,823	1,876	1,508	1,406	1,457	1,426	1,326	1,126	924	594	280	123	23,200
1987	1,535	1,576	1,585	1,536	1,483	1,495	1,557	1,795	1,838	1,463	1,341	1,353	1,274	1,116	868	613	309	137	22,874
1992	1,471	1,515	1,566	1,573	1,518	1,463	1,474	1,532	1,758	1,782	1,394	1,245	1,209	1,073	859	575	319	152	22,478
1997	1,429	1,452	1,506	1,555	1,555	1,498	1,443	1,451	1,501	1,705	1,698	1,294	1,112	1,017	826	570	300	159	22,071
2002	1,412	1,410	1,443	1,495	1,537	1,535	1,478	1,421	1,421	1,455	1,625	1,577	1,156	936	784	548	297	154	21,684
2007	1,403	1,393	1,401	1,433	1,478	1,517	1,514	1,455	1,391	1,378	1,387	1,509	1,409	973	721	519	285	150	21,316
2012	1,387	1,384	1,385	1,391	1,416	1,458	1,496	1,490	1,424	1,349	1,314	1,288	1,348	1,186	749	478	270	145	20,958
2017	1,358	1,369	1,376	1,375	1,375	1,397	1,438	1,473	1,459	1,381	1,286	1,220	1,151	1,134	913	497	249	139	20,590
2022	1,323	1,340	1,361	1,366	1,359	1,357	1,378	1,416	1,442	1,415	1,317	1,194	1,090	969	874	606	259	129	20,195
2027	1,291	1,305	1,332	1,351	1,350	1,341	1,338	1,357	1,386	1,399	1,349	1,223	1,067	917	746	579	315	129	19,775
2032	1,267	1,274	1,297	1,323	1,336	1,332	1,323	1,318	1,329	1,344	1,333	1,253	1,092	898	706	495	302	153	19,375
2037	1,248	1,250	1,266	1,288	1,308	1,318	1,314	1,302	1,290	1,288	1,282	1,238	1,119	919	692	468	258	152	19,000
2042	1,226	1,231	1,243	1,257	1,273	1,290	1,300	1,293	1,275	1,251	1,228	1,190	1,106	942	708	459	244	135	18,651
2047	1,203	1,210	1,224	1,234	1,243	1,256	1,272	1,280	1,267	1,237	1,193	1,140	1,063	931	725	469	239	125	18,311

C. FEMALES IN QUINQUENNIAL AGE-GROUPS, 1947-2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	1,937	1,591	1,530	1,657	1,760	1,827	1,840	1,941	1,865	1,743	1,577	1,430	1,285	1,101	842	539	283	136	24,884
1952	1,876	1,915	1,584	1,520	1,640	1,740	1,805	1,817	1,910	1,824	1,689	1,507	1,334	1,150	917	622	328	174	25,352
1957	1,603	1,855	1,906	1,574	1,506	1,622	1,719	1,783	1,788	1,869	1,768	1,614	1,407	1,195	958	678	379	205	25,429
1962	1,516	1,585	1,846	1,894	1,558	1,488	1,601	1,697	1,754	1,750	1,811	1,690	1,507	1,259	995	708	412	239	25,310
1967	1,486	1,499	1,578	1,835	1,875	1,540	1,470	1,581	1,670	1,716	1,696	1,731	1,577	1,349	1,049	736	431	262	25,081
1972	1,521	1,469	1,492	1,568	1,817	1,853	1,522	1,452	1,556	1,634	1,664	1,620	1,615	1,412	1,123	775	448	279	24,820
1977	1,558	1,504	1,462	1,483	1,552	1,796	1,831	1,502	1,428	1,523	1,584	1,589	1,512	1,446	1,176	830	472	291	24,539
1982	1,540	1,541	1,497	1,453	1,468	1,534	1,774	1,808	1,478	1,398	1,476	1,513	1,483	1,354	1,205	869	506	304	24,201
1987	1,479	1,523	1,534	1,488	1,439	1,451	1,516	1,752	1,780	1,446	1,354	1,410	1,412	1,328	1,127	890	530	325	23,784
1992	1,418	1,463	1,516	1,524	1,473	1,422	1,434	1,497	1,724	1,742	1,403	1,295	1,316	1,265	1,106	834	542	342	23,316
1997	1,378	1,402	1,456	1,506	1,509	1,456	1,405	1,416	1,473	1,687	1,688	1,340	1,208	1,179	1,054	817	508	351	22,833
2002	1,362	1,363	1,396	1,447	1,491	1,491	1,439	1,387	1,393	1,441	1,635	1,612	1,251	1,082	982	778	498	339	22,387
2007	1,353	1,347	1,356	1,387	1,432	1,474	1,474	1,420	1,365	1,363	1,397	1,562	1,506	1,119	901	725	474	330	21,985
2012	1,337	1,337	1,341	1,348	1,373	1,416	1,457	1,455	1,398	1,336	1,321	1,335	1,458	1,347	933	666	442	317	21,617
2017	1,310	1,322	1,331	1,332	1,335	1,358	1,399	1,438	1,432	1,368	1,295	1,263	1,246	1,305	1,123	689	405	296	21,247
2022	1,275	1,295	1,316	1,323	1,319	1,319	1,341	1,381	1,415	1,401	1,326	1,237	1,179	1,115	1,087	829	420	273	20,851
2027	1,245	1,261	1,289	1,308	1,310	1,304	1,303	1,324	1,359	1,385	1,358	1,267	1,154	1,055	929	803	505	273	20,432
2032	1,221	1,231	1,255	1,281	1,295	1,295	1,288	1,287	1,303	1,330	1,342	1,297	1,182	1,034	879	686	489	315	20,010
2037	1,202	1,208	1,225	1,248	1,268	1,280	1,279	1,272	1,267	1,275	1,289	1,282	1,211	1,058	861	649	418	321	19,613
2042	1,181	1,189	1,202	1,218	1,235	1,254	1,265	1,263	1,252	1,239	1,236	1,232	1,197	1,084	882	636	396	288	19,249
2047	1,160	1,168	1,183	1,194	1,206	1,221	1,239	1,249	1,243	1,225	1,201	1,181	1,150	1,072	903	651	388	265	18,899

PROJECTION 3

(Assumptions: *Mortality 'Constant'; Marriage-rates 'Intermediate 1942–47', Fertility '1935–38'; Net Migration Nil*)*

A. PERSONS IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	3,971	3,239	3,105	3,357	3,531	3,646	3,650	3,839	3,666	3,323	2,894	2,624	2,318	1,968	1,490	919	450	198	48,188
1952	3,796	3,922	3,221	3,083	3,321	3,488	3,599	3,599	3,769	3,571	3,196	2,729	2,400	2,019	1,585	1,052	525	254	49,129
1957	3,206	3,750	3,901	3,200	3,052	3,280	3,442	3,548	3,533	3,672	3,433	3,013	2,499	2,093	1,627	1,121	602	300	49,272
1962	3,013	3,167	3,729	3,875	3,165	3,013	3,236	3,394	3,483	3 442	3,529	3,236	2,756	2,178	1,687	1,152	643	349	49,047
1967	2,959	2,977	3,150	3,705	3,833	3,126	2,974	3,191	3,332	3,393	3,309	3,327	2,958	2,400	1,757	1,194	662	377	48,624
1972	3,034	2,923	2,961	3,129	3,665	3,785	3,086	2,933	3,133	3,245	3,263	3,118	3,040	2,574	1,933	1,245	686	396	48,149
1977	3,069	2,997	2,908	2,941	3,096	3,619	3,736	3,041	2,878	3,052	3,120	3,073	2,850	2,645	2,071	1,367	717	411	47,591
1982	2,985	3,031	2,981	2,888	2,909	3,057	3,573	3,684	2,986	2,804	2,933	2,939	2,809	2,480	2,129	1,463	786	427	46,864
1987	2,838	2,949	3,015	2,961	2,857	2,873	3,017	3,522	3,618	2,909	2,695	2,763	2,686	2,444	1,995	1,503	839	462	45,946
1992	2,716	2,804	2,933	2,995	2,930	2,821	2,836	2,975	3,458	3,524	2,797	2,540	2,525	2,338	1,965	1,409	861	494	44,921
1997	2,644	2,682	2,788	2,913	2,963	2,893	2,786	2,796	2,921	3,368	3,386	2,634	2,320	2,196	1,880	1,387	808	510	43,875
2002	2,607	2,612	2,668	2,770	2,882	2,926	2,856	2,746	2,744	2,845	3,237	3,189	2,407	2,018	1,766	1,326	795	493	42,887
2007	2,570	2,576	2,598	2,650	2,741	2,846	2,888	2,815	2,696	2,673	2,734	3,050	2,915	2,092	1,622	1,244	759	480	41,949
2012	2,510	2,538	2,562	2,581	2,622	2,706	2,809	2,848	2,764	2,626	2,570	2,576	2,787	2,533	1,682	1,144	712	462	41,032
2017	2,435	2,479	2,525	2,545	2,553	2,589	2,671	2,770	2,796	2,692	2,524	2,421	2,354	2,423	2,036	1,186	654	435	40,088
2022	2,360	2,406	2,465	2,508	2,518	2,522	2,555	2,633	2,719	2,723	2,587	2,378	2,212	2,047	1,947	1,435	679	402	39,096
2027	2,297	2,332	2,393	2,449	2,481	2,486	2,489	2,519	2,586	2,648	2,617	2,437	2,172	1,923	1,645	1,373	820	402	38,069
2032	2,244	2,268	2,319	2,377	2,423	2,450	2,454	2,453	2,474	2,518	2,545	2,466	2,227	1,889	1,546	1,160	785	468	37,066
2037	2,195	2,217	2,256	2,304	2,352	2,393	2,419	2,419	2,409	2,409	2,420	2,398	2,253	1,936	1,518	1,090	663	472	36,123
2042	2,142	2,168	2,205	2,241	2,280	2,322	2,362	2,385	2,375	2,346	2,315	2,280	2,192	1,958	1,556	1,070	624	418	35,239
2047	2,087	2,115	2,156	2,190	2,217	2,251	2,293	2,328	2,341	2,313	2,255	2,182	2,083	1,905	1,574	1,098	613	383	34,384

* For a fuller definition of the assumptions, see paras 5–18 of the report above.

B. MALES IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	2,034	1,648	1,575	1,700	1,771	1,819	1,810	1,898	1,801	1,580	1,317	1,194	1,033	867	648	380	167	62	23,304
1952	1,932	2,007	1,637	1,563	1,681	1,748	1,794	1,782	1,859	1,747	1,507	1,222	1,066	869	668	430	197	80	23,789
1957	1,633	1,907	1,995	1,626	1,546	1,658	1,723	1,765	1,745	1,803	1,665	1,399	1,092	898	669	443	223	95	23,885
1962	1,534	1,611	1,895	1,981	1,607	1,525	1,635	1,697	1,729	1,692	1,718	1,546	1,249	919	692	444	231	110	23,815
1967	1,507	1,514	1,601	1,882	1,958	1,586	1,504	1,610	1,662	1,677	1,613	1,596	1,381	1,051	708	458	231	115	23,654
1972	1,544	1,487	1,505	1,590	1,860	1,932	1,564	1,481	1,577	1,611	1,599	1,498	1,425	1,162	810	470	238	117	23,470
1977	1,562	1,524	1,478	1,494	1,572	1,835	1,905	1,539	1,450	1,529	1,536	1,484	1,338	1,199	895	537	245	120	23,242
1982	1,520	1,541	1,515	1,467	1,477	1,551	1,810	1,876	1,508	1,406	1,457	1,426	1,326	1,126	924	594	280	123	22,927
1987	1,445	1,500	1,532	1,504	1,450	1,457	1,529	1,782	1,838	1,463	1,341	1,353	1,274	1,116	868	613	309	137	22,511
1992	1,383	1,426	1,491	1,521	1,487	1,431	1,437	1,506	1,745	1,782	1,394	1,245	1,209	1,073	859	575	319	152	22,035
1997	1,346	1,364	1,417	1,480	1,504	1,467	1,412	1,415	1,475	1,692	1,698	1,294	1,112	1,017	826	570	300	159	21,548
2002	1,327	1,328	1,356	1,407	1,463	1,484	1,447	1,390	1,385	1,430	1,613	1,577	1,156	936	784	548	297	154	21,082
2007	1,309	1,310	1,320	1,347	1,391	1,444	1,463	1,424	1,361	1,343	1,363	1,498	1,409	973	721	519	285	150	20,630
2012	1,278	1,291	1,302	1,311	1,331	1,372	1,424	1,441	1,395	1,320	1,281	1,266	1,338	1,186	749	478	270	145	20,178
2017	1,240	1,261	1,284	1,293	1,296	1,313	1,353	1,402	1,411	1,353	1,258	1,189	1,131	1,126	913	497	249	139	19,708
2022	1,201	1,224	1,253	1,274	1,278	1,279	1,295	1,332	1,373	1,368	1,289	1,168	1,062	952	867	606	259	129	19,209
2027	1,170	1,186	1,216	1,244	1,260	1,261	1,261	1,275	1,305	1,331	1,304	1,197	1,043	894	733	575	315	129	18,699
2032	1,142	1,154	1,178	1,208	1,230	1,243	1,243	1,241	1,249	1,265	1,269	1,211	1,069	878	689	486	299	153	18,207
2037	1,118	1,127	1,147	1,170	1,194	1,214	1,226	1,224	1,216	1,211	1,206	1,178	1,082	900	676	457	253	152	17,751
2042	1,091	1,103	1,120	1,139	1,157	1,178	1,197	1,207	1,199	1,179	1,154	1,120	1,053	910	693	448	238	134	17,320
2047	1,062	1,076	1,096	1,112	1,126	1,141	1,162	1,178	1,182	1,162	1,124	1,072	1,000	886	701	460	234	123	16,897

C. FEMALES IN QUINQUENNIAL AGE GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	1,937	1,591	1,530	1,657	1,760	1,827	1,840	1,941	1,865	1,743	1,577	1,430	1,285	1,101	842	539	283	136	24,884
1952	1,864	1,915	1,584	1,520	1,640	1,740	1,805	1,817	1,910	1,824	1,689	1,507	1,334	1,150	917	622	328	174	25,340
1957	1,573	1,843	1,906	1,574	1,506	1,622	1,719	1,783	1,788	1,869	1,768	1,614	1,407	1,195	958	678	379	205	25,387
1962	1,479	1,556	1,834	1,894	1,558	1,488	1,601	1,697	1,754	1,750	1,811	1,690	1,507	1,259	995	708	412	239	25,232
1967	1,452	1,463	1,549	1,823	1,875	1,540	1,470	1,581	1,670	1,716	1,696	1,731	1,577	1,349	1,049	736	431	262	24,970
1972	1,490	1,436	1,456	1,539	1,805	1,853	1,522	1,452	1,556	1,634	1,664	1,620	1,615	1,412	1,123	775	448	279	24,679
1977	1,507	1,473	1,430	1,447	1,524	1,784	1,831	1,502	1,428	1,523	1,584	1,589	1,512	1,446	1,176	830	472	291	24,349
1982	1,465	1,490	1,466	1,421	1,432	1,506	1,763	1,808	1,478	1,398	1,476	1,513	1,483	1,354	1,205	869	506	304	23,937
1987	1,393	1,449	1,483	1,457	1,407	1,416	1,488	1,740	1,780	1,446	1,354	1,410	1,412	1,328	1,127	890	530	325	23,435
1992	1,333	1,378	1,442	1,474	1,443	1,390	1,399	1,469	1,713	1,742	1,403	1,295	1,316	1,265	1,106	834	542	342	22,886
1997	1,298	1,318	1,371	1,433	1,459	1,426	1,374	1,381	1,446	1,676	1,688	1,340	1,208	1,179	1,054	817	508	351	22,327
2002	1,280	1,284	1,312	1,363	1,419	1,442	1,409	1,356	1,359	1,415	1,624	1,612	1,251	1,082	982	778	498	339	21,805
2007	1,261	1,266	1,278	1,303	1,350	1,402	1,425	1,391	1,335	1,330	1,371	1,552	1,506	1,119	901	725	474	330	21,319
2012	1,232	1,247	1,260	1,270	1,291	1,334	1,385	1,407	1,369	1,306	1,289	1,310	1,449	1,347	933	666	442	317	20,854
2017	1,195	1,218	1,241	1,252	1,257	1,276	1,318	1,368	1,385	1,339	1,266	1,232	1,223	1,297	1,123	689	405	296	20,380
2022	1,159	1,182	1,212	1,234	1,240	1,243	1,260	1,301	1,346	1,355	1,298	1,210	1,150	1,095	1,080	829	420	273	19,887
2027	1,127	1,146	1,177	1,205	1,221	1,225	1,228	1,244	1,281	1,317	1,313	1,240	1,129	1,029	912	798	505	273	19,370
2032	1,102	1,114	1,141	1,169	1,193	1,207	1,211	1,212	1,225	1,253	1,276	1,255	1,158	1,011	857	674	486	315	18,859
2037	1,077	1,090	1,109	1,134	1,158	1,179	1,193	1,195	1,193	1,198	1,214	1,220	1,171	1,036	842	633	410	320	18,372
2042	1,051	1,065	1,085	1,102	1,123	1,144	1,165	1,178	1,176	1,167	1,161	1,160	1,139	1,048	863	622	386	284	17,919
2047	1,025	1,039	1,060	1,078	1,091	1,110	1,131	1,150	1,159	1,151	1,131	1,110	1,083	1,019	873	638	379	260	17,487

(Assumptions: *Mortality 'Constant'; Marriage 'Later', Fertility '1935–38', Net Migration Nil*)*

A. PERSONS IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	3,971	3,239	3,105	3,357	3,531	3,646	3,650	3,839	3,666	3,323	2,894	2,624	2,318	1,968	1,490	919	450	198	48,188
1952	3,679	3,922	3,221	3,083	3,321	3,488	3,599	3,599	3,769	3,571	3,196	2,729	2,400	2,019	1,585	1,052	525	254	49,012
1957	2,995	3,633	3,901	3,200	3,052	3,280	3,442	3,548	3,533	3,672	3,433	3,013	2,499	2,093	1,627	1,121	602	300	48,944
1962	2,819	2,957	3,614	3,875	3,165	3,013	3,236	3,394	3,483	3,442	3,529	3,236	2,756	2,178	1,687	1,152	643	349	48,528
1967	2,808	2,785	2,941	3,590	3,833	3,126	2,974	3,191	3,332	3,393	3,309	3,327	2,958	2,400	1,757	1,194	662	377	47,957
1972	2,898	2,774	2,770	2,922	3,552	3,785	3,086	2,933	3,133	3,245	3,263	3,118	3,040	2,574	1,933	1,245	686	396	47,353
1977	2,913	2,862	2,758	2,752	2,891	3,507	3,736	3,041	2,878	3,052	3,120	3,073	2,850	2,645	2,071	1,367	717	411	46,644
1982	2,783	2,878	2,848	2,740	2,722	2,855	3,463	3,684	2,986	2,804	2,933	2,939	2,809	2,480	2,129	1,463	786	427	45,729
1987	2,604	2,749	2,862	2,828	2,711	2,688	2,818	3,413	3,618	2,909	2,695	2,763	2,686	2,444	1,995	1,503	839	462	44,587
1992	2,477	2,573	2,733	2,842	2,798	2,677	2,654	2,778	3,351	3,524	2,797	2,540	2,525	2,338	1,965	1,409	861	494	43,336
1997	2,416	2,447	2,559	2,716	2,813	2,763	2,642	2,616	2,728	3,263	3,386	2,634	2,320	2,196	1,880	1,387	808	510	42,084
2002	2,382	2,386	2,434	2,542	2,687	2,777	2,728	2,606	2,568	2,656	3,137	3,189	2,407	2,018	1,766	1,326	795	493	40,897
2007	2,334	2,353	2,373	2,418	2,515	2,653	2,742	2,689	2,558	2,501	2,554	2,956	2,915	2,092	1,622	1,244	759	480	39,758
2012	2,256	2,306	2,340	2,357	2,392	2,484	2,619	2,703	2,640	2,491	2,404	2,406	2,700	2,533	1,682	1,144	712	462	38,631
2017	2,167	2,229	2,294	2,324	2,333	2,361	2,452	2,581	2,654	2,571	2,395	2,265	2,198	2,348	2,036	1,186	654	435	37,483
2022	2,088	2,140	2,216	2,278	2,299	2,303	2,331	2,417	2,534	2,584	2,471	2,256	2,070	1,912	1,888	1,435	679	402	36,303
2027	2,025	2,063	2,129	2,202	2,254	2,271	2,274	2,299	2,373	2,469	2,484	2,328	2,061	1,800	1,536	1,331	820	402	35,121
2032	1,970	2,001	2,052	2,115	2,178	2,226	2,241	2,241	2,257	2,311	2,373	2,340	2,127	1,792	1,446	1,083	761	468	33,982
2037	1,915	1,946	1,990	2,039	2,093	2,151	2,197	2,209	2,201	2,198	2,221	2,235	2,138	1,850	1,441	1,020	619	461	32,924
2042	1,857	1,892	1,936	1,976	2,017	2,067	2,123	2,166	2,169	2,143	2,113	2,092	2,043	1,860	1,487	1,016	583	395	31,935
2047	1,793	1,834	1,882	1,923	1,955	1,991	2,039	2,093	2,126	2,113	2,060	1,990	1,913	1,776	1,495	1,048	582	358	30,971

* For a fuller definition of the assumptions, see paras 5–18 of the report above

B. MALES IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50 54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	2,034	1,648	1,575	1,700	1,771	1,819	1,810	1,898	1,801	1,580	1,317	1,194	1,033	867	648	380	167	62	23,304
1952	1,873	2,007	1,637	1,563	1,681	1,748	1,794	1,782	1,859	1,747	1,507	1,222	1,066	869	668	430	197	80	23,730
1957	1,525	1,848	1,995	1,626	1,546	1,658	1,723	1,765	1,745	1,803	1,665	1,399	1,092	898	669	443	223	95	23,718
1962	1,435	1,504	1,837	1,981	1,607	1,525	1,635	1,697	1,729	1,692	1,718	1,546	1,249	919	692	444	231	110	23,551
1967	1,430	1,416	1,495	1,824	1,958	1,586	1,504	1,610	1,662	1,677	1,613	1,596	1,381	1,051	708	458	231	115	23,315
1972	1,475	1,411	1,408	1,485	1,803	1,932	1,564	1,481	1,577	1,611	1,599	1,498	1,425	1,162	810	470	238	117	23,066
1977	1,483	1,455	1,402	1,398	1,468	1,779	1,905	1,539	1,450	1,529	1,536	1,484	1,338	1,199	895	537	245	120	22,762
1982	1,417	1,464	1,447	1,392	1,382	1,448	1,755	1,876	1,508	1,406	1,457	1,426	1,326	1,126	924	594	280	123	22,351
1987	1,326	1,398	1,455	1,436	1,376	1,363	1,428	1,727	1,838	1,463	1,341	1,353	1,274	1,116	868	613	309	137	21,821
1992	1,261	1,309	1,389	1,444	1,420	1,358	1,345	1,406	1,692	1,782	1,394	1,245	1,209	1,073	859	575	319	152	21,232
1997	1,230	1,244	1,301	1,380	1,428	1,401	1,339	1,324	1,377	1,640	1,698	1,294	1,112	1,017	826	570	300	159	20,640
2002	1,213	1,213	1,237	1,292	1,364	1,409	1,382	1,319	1,296	1,335	1,564	1,577	1,156	936	784	548	297	154	20,076
2007	1,188	1,197	1,206	1,228	1,277	1,346	1,390	1,360	1,291	1,257	1,273	1,452	1,409	973	721	519	285	150	19,522
2012	1,149	1,173	1,190	1,197	1,214	1,260	1,327	1,368	1,332	1,252	1,198	1,182	1,297	1,186	749	478	270	145	18,967
2017	1,103	1,134	1,166	1,181	1,184	1,197	1,243	1,306	1,340	1,292	1,194	1,113	1,056	1,092	913	497	249	139	18,399
2022	1,063	1,088	1,127	1,157	1,167	1,168	1,181	1,223	1,279	1,299	1,231	1,108	994	889	841	606	259	129	17,809
2027	1,031	1,049	1,082	1,119	1,144	1,152	1,152	1,163	1,198	1,241	1,238	1,143	990	837	684	558	315	129	17,225
2032	1,003	1,018	1,043	1,074	1,106	1,129	1,136	1,134	1,139	1,162	1,183	1,150	1,021	833	644	454	290	153	16,672
2037	975	990	1,012	1,036	1,062	1,091	1,113	1,118	1,111	1,104	1,107	1,098	1,027	860	642	427	236	148	16,157
2042	945	962	984	1,004	1,024	1,048	1,076	1,096	1,095	1,077	1,053	1,028	981	865	662	426	222	126	15,674
2047	913	932	956	977	993	1,010	1,033	1,059	1,073	1,062	1,027	977	919	826	666	439	222	115	15,199

C. FEMALES IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	1,937	1,591	1,530	1,657	1,760	1,827	1,840	1,941	1,865	1,743	1,577	1,430	1,285	1,101	842	539	283	136	24,884
1952	1,806	1,915	1,584	1,520	1,640	1,740	1,805	1,817	1,910	1,824	1,689	1,507	1,334	1,150	917	622	328	174	25,282
1957	1,470	1,785	1,906	1,574	1,506	1,622	1,719	1,783	1,788	1,869	1,768	1,614	1,407	1,195	958	678	379	205	25,226
1962	1,384	1,453	1,777	1,894	1,558	1,488	1,601	1,697	1,754	1,750	1,811	1,690	1,507	1,259	995	708	412	239	24,977
1967	1,378	1,369	1,446	1,766	1,875	1,540	1,470	1,581	1,670	1,716	1,696	1,731	1,577	1,349	1,049	736	431	262	24,642
1972	1,423	1,363	1,362	1,437	1,749	1,853	1,522	1,452	1,556	1,634	1,664	1,620	1,615	1,412	1,123	775	448	279	24,287
1977	1,430	1,407	1,356	1,354	1,423	1,728	1,831	1,502	1,428	1,523	1,584	1,589	1,512	1,446	1,176	830	472	291	23,882
1982	1,366	1,414	1,401	1,348	1,340	1,407	1,708	1,808	1,478	1,398	1,476	1,513	1,483	1,354	1,205	869	506	304	23,378
1987	1,278	1,351	1,407	1,392	1,335	1,325	1,390	1,686	1,780	1,446	1,354	1,410	1,412	1,328	1,127	890	530	325	22,766
1992	1,216	1,264	1,344	1,398	1,378	1,319	1,309	1,372	1,659	1,742	1,403	1,295	1,316	1,265	1,106	834	542	342	22,104
1997	1,186	1,203	1,258	1,336	1,385	1,362	1,303	1,292	1,351	1,623	1,688	1,340	1,208	1,179	1,054	817	508	351	21,444
2002	1,169	1,173	1,197	1,250	1,323	1,368	1,346	1,287	1,272	1,321	1,573	1,612	1,251	1,082	982	778	498	339	20,821
2007	1,446	1,156	1,167	1,190	1,238	1,307	1,352	1,329	1,267	1,244	1,281	1,504	1,506	1,119	901	725	474	330	20,236
2012	1,107	1,133	1,150	1,160	1,178	1,224	1,292	1,335	1,308	1,239	1,206	1,224	1,403	1,347	933	666	442	317	19,664
2017	1,064	1,095	1,128	1,143	1,149	1,164	1,209	1,275	1,314	1,279	1,201	1,152	1,142	1,256	1,123	689	405	296	19,084
2022	1,025	1,052	1,089	1,121	1,132	1,135	1,150	1,194	1,255	1,285	1,240	1,148	1,076	1,023	1,047	829	420	273	18,494
2027	994	1,014	1,047	1,083	1,110	1,119	1,122	1,136	1,175	1,228	1,246	1,185	1,071	963	852	773	505	273	17,896
2032	967	983	1,009	1,041	1,072	1,097	1,105	1,107	1,118	1,149	1,190	1,190	1,106	959	802	629	471	315	17,310
2037	940	956	978	1,003	1,031	1,060	1,084	1,091	1,090	1,094	1,114	1,137	1,111	990	799	593	383	313	16,767
2042	912	930	952	972	993	1,019	1,047	1,070	1,074	1,066	1,060	1,064	1,062	995	825	590	361	269	16,261
2047	880	902	926	946	962	981	1,006	1,034	1,053	1,051	1,033	1,013	994	950	829	609	360	243	15,772

PROJECTION 5

(Assumptions: *Mortality 'Constant', Marriage 'Earlier', Fertility '1935–38', Net Migration Nil*)*

A. PERSONS IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	3,971	3,239	3,105	3,357	3,531	3,646	3 650	3,839	3,666	3,323	2,894	2,624	2,318	1,968	1,490	919	450	198	48,188
1952	3,856	3,922	3,221	3,083	3,321	3,488	3,599	3,599	3,769	3,571	3,196	2,729	2,400	2,019	1,585	1,052	525	254	49,189
1957	3,300	3,809	3,901	3,200	3,052	3,280	3,442	3,548	3,533	3,672	3,433	3,013	2,499	2,093	1,627	1,121	602	300	49,425
1962	3,048	3,259	3,789	3 875	3,165	3,013	3,236	3,394	3,483	3,442	3,529	3,236	2,756	2,178	1,687	1,152	643	349	49,234
1967	2,972	3,011	3,241	3,764	3,833	3,126	2,974	3,191	3,332	3,393	3,309	3,327	2,958	2,400	1,757	1,194	662	377	48,821
1972	3,035	2,936	2,995	3,221	3,723	3,785	3,086	2,933	3,133	3,245	3,263	3,118	3,040	2,574	1,933	1,245	686	396	48,347
1977	3,012	2,998	2,920	2,975	3,186	3,677	3,736	3,041	2,878	3,052	3,120	3,073	2,850	2,645	2,071	1,367	717	411	47,729
1982	2,870	2,976	2,982	2,901	2,943	3,146	3,629	3,684	2,986	2,804	2,933	2,939	2,809	2,480	2,129	1,463	786	427	46,887
1987	2,708	2,834	2,960	2,962	2,870	2,906	3,105	3,579	3,618	2,909	2,695	2 763	2,686	2,444	1,995	1,503	839	462	45,838
1992	2,596	2,675	2,819	2,940	2,931	2,834	2,869	3,062	3,513	3,524	2,797	2,540	2,525	2,338	1,965	1,409	861	494	44,692
1997	2,534	2,563	2,661	2,801	2,909	2,894	2,798	2,828	3,006	3,421	3,386	2,634	2,320	2,196	1,880	1,387	808	510	43,536
2002	2,480	2,503	2,549	2,643	2,770	2,872	2,857	2,758	2,777	2,928	3,289	3,189	2,407	2,018	1,766	1,326	795	493	42,420
2007	2,404	2,451	2,489	2,533	2,615	2,736	2,835	2,816	2,708	2,704	2,814	3,098	2,915	2,092	1,622	1,244	759	480	41,315
2012	2,313	2,375	2,437	2,473	2,505	2,582	2,700	2,795	2,765	2,637	2,600	2,651	2,831	2,533	1,682	1,144	712	462	40,197
2017	2,227	2,285	2,363	2,421	2,447	2,474	2,549	2,662	2,743	2,692	2,535	2,449	2,422	2,461	2,036	1,186	654	435	39,041
2022	2,153	2,199	2,273	2,346	2,395	2,416	2,442	2,513	2,614	2,672	2,588	2,388	2,238	2,106	1,978	1,435	679	402	37,837
2027	2,088	2,128	2,187	2,258	2,321	2,365	2,385	2,408	2,466	2,546	2,569	2,438	2,182	1,945	1,693	1,395	820	402	36,596
2032	2,025	2,063	2,116	2,173	2,234	2,293	2,335	2,351	2,364	2,403	2,448	2,420	2,228	1,897	1,564	1,194	798	468	35,374
2037	1,956	2,000	2,052	2,102	2,149	2,206	2,263	2,302	2,308	2,303	2,309	2,305	2,211	1,937	1,525	1,103	683	376	34,190
2042	1,888	1,933	1,989	2,039	2,079	2,123	2,178	2,231	2,260	2,249	2,214	2,175	2,107	1,923	1,557	1,075	631	427	33,078
2047	1,826	1,865	1,922	1,976	2,017	2,053	2,095	2,146	2,190	2,202	2,161	2,085	1,988	1,831	1,546	1,098	616	389	32,006

* For a fuller definition of the assumptions, see paras 5–18 of the report above

B. MALES IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	2,034	1,648	1,575	1,700	1,771	1,819	1,810	1,898	1,801	1,580	1,317	1,194	1,033	867	648	380	167	62	23,304
1952	1,963	2,007	1,637	1,563	1,681	1,748	1,794	1,782	1,859	1,747	1,507	1,222	1,066	869	668	430	197	80	23,820
1957	1,680	1,937	1,995	1,626	1,546	1,658	1,723	1,765	1,745	1,803	1,665	1,399	1,092	898	669	443	223	95	23,962
1962	1,552	1,657	1,926	1,981	1,607	1,525	1,635	1,697	1,729	1,692	1,718	1,546	1,249	919	692	444	231	110	23,910
1967	1,513	1,531	1,647	1,912	1,958	1,586	1,504	1,610	1,662	1,677	1,613	1,596	1,381	1,051	708	458	231	115	23,753
1972	1,545	1,493	1,522	1,636	1,890	1,932	1,564	1,481	1,577	1,611	1,599	1,498	1,425	1,162	810	470	238	117	23,570
1977	1,534	1,525	1,484	1,511	1,617	1,865	1,905	1,539	1,450	1,529	1,536	1,484	1,338	1,199	895	537	245	120	23,313
1982	1,461	1,514	1,516	1,474	1,494	1,595	1,839	1,876	1,508	1,406	1,457	1,426	1,326	1,126	924	594	280	123	22,939
1987	1,379	1,441	1,505	1,505	1,457	1,474	1,573	1,811	1,838	1,463	1,341	1,353	1,274	1,116	868	613	309	137	22,457
1992	1,322	1,361	1,433	1,494	1,488	1,437	1,454	1,549	1,773	1,782	1,394	1,245	1,209	1,073	859	575	319	152	21,919
1997	1,290	1,304	1,353	1,423	1,477	1,468	1,418	1,431	1,517	1,719	1,698	1,294	1,112	1,017	826	570	300	159	21,376
2002	1,263	1,273	1,296	1,343	1,406	1,457	1,448	1,396	1,402	1,471	1,639	1,577	1,156	936	784	548	297	154	20,846
2007	1,224	1,247	1,265	1,287	1,328	1,388	1,437	1,425	1,367	1,359	1,402	1,522	1,409	973	721	519	285	150	20,308
2012	1,178	1,208	1,239	1,256	1,272	1,310	1,368	1,415	1,396	1,325	1,296	1,302	1,360	1,186	749	478	270	145	19,753
2017	1,134	1,162	1,201	1,230	1,242	1,255	1,292	1,347	1,385	1,353	1,264	1,203	1,163	1,144	913	497	249	139	19,173
2022	1,096	1,119	1,155	1,192	1,216	1,225	1,238	1,272	1,319	1,343	1,290	1,173	1,075	979	881	606	259	129	18,567
2027	1,063	1,082	1,112	1,147	1,178	1,200	1,208	1,219	1,245	1,279	1,281	1,198	1,048	904	754	584	315	129	17,946
2032	1,031	1,049	1,075	1,104	1,134	1,163	1,184	1,189	1,194	1,208	1,220	1,189	1,070	882	697	500	304	153	17,346
2037	996	1,017	1,043	1,068	1,091	1,119	1,147	1,165	1,165	1,158	1,151	1,132	1,062	901	679	462	260	153	16,769
2042	961	983	1,011	1,036	1,055	1,077	1,104	1,129	1,141	1,130	1,104	1,069	1,012	894	694	450	241	136	16,227
2047	929	948	977	1,004	1,024	1,041	1,062	1,086	1,105	1,107	1,077	1,025	955	851	689	460	235	125	15,700

C. FEMALES IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	1,937	1,591	1,530	1,657	1,760	1,827	1,840	1,941	1,865	1,743	1,577	1,430	1,285	1,101	842	539	283	136	24,884
1952	1,893	1,915	1,584	1,520	1,640	1,740	1,805	1,817	1,910	1,824	1,689	1,507	1,334	1,150	917	622	328	174	25,369
1957	1,620	1,872	1,906	1,574	1,506	1,622	1,719	1,783	1,788	1,869	1,768	1,614	1,407	1,195	958	678	379	205	25,463
1962	1,496	1,602	1,863	1,894	1,558	1,488	1,601	1,697	1,754	1,750	1,811	1,690	1,507	1,259	995	708	412	239	25,324
1967	1,459	1,480	1,594	1,852	1,875	1,540	1,470	1,581	1,670	1,716	1,696	1,731	1,577	1,349	1,049	736	431	262	25,068
1972	1,490	1,443	1,473	1,585	1,833	1,853	1,522	1,452	1,556	1,634	1,664	1,620	1,615	1,412	1,123	775	448	279	24,777
1977	1,478	1,473	1,436	1,464	1,569	1,812	1,831	1,502	1,428	1,523	1,584	1,589	1,512	1,446	1,176	830	472	291	24,416
1982	1,409	1,462	1,466	1,427	1,449	1,551	1,790	1,808	1,478	1,398	1,476	1,513	1,483	1,354	1,205	869	506	304	23,948
1987	1,329	1,393	1,455	1,457	1,413	1,432	1,532	1,768	1,780	1,446	1,354	1,410	1,412	1,328	1,127	890	530	325	23,381
1992	1,274	1,314	1,386	1,446	1,443	1,397	1,415	1,513	1,740	1,742	1,403	1,295	1,316	1,265	1,106	834	542	342	22,773
1997	1,244	1,259	1,308	1,378	1,432	1,426	1,380	1,397	1,489	1,702	1,688	1,340	1,208	1,179	1,054	817	508	351	22,160
2002	1,217	1,230	1,253	1,300	1,364	1,415	1,409	1,362	1,375	1,457	1,650	1,612	1,251	1,082	982	778	498	339	21,574
2007	1,180	1,204	1,224	1,246	1,287	1,348	1,398	1,391	1,341	1,345	1,412	1,576	1,506	1,119	901	725	474	330	21,007
2012	1,135	1,167	1,198	1,217	1,233	1,272	1,332	1,380	1,369	1,312	1,304	1,349	1,471	1,347	933	666	442	317	20,444
2017	1,093	1,123	1,162	1,191	1,205	1,219	1,257	1,315	1,358	1,339	1,271	1,246	1,259	1,317	1,123	689	405	296	19,868
2022	1,057	1,080	1,118	1,154	1,179	1,191	1,204	1,241	1,295	1,329	1,298	1,215	1,163	1,127	1,097	829	420	273	19,270
2027	1,025	1,046	1,075	1,111	1,143	1,165	1,177	1,189	1,221	1,267	1,288	1,240	1,134	1,041	939	811	505	273	18,650
2032	994	1,014	1,041	1,069	1,100	1,130	1,151	1,162	1,170	1,195	1,228	1,231	1,158	1,015	867	694	494	315	18,028
2037	960	983	1,009	1,034	1,058	1,087	1,116	1,137	1,143	1,145	1,158	1,173	1,149	1,036	846	641	423	323	17,421
2042	927	950	978	1,003	1,024	1,046	1,074	1,102	1,119	1,119	1,110	1,106	1,095	1,029	863	625	390	291	16,851
2047	897	917	945	972	993	1,012	1,033	1,060	1,085	1,095	1,084	1,060	1,033	980	857	638	381	264	16,306

PROJECTION 6

(Assumptions: *Mortality 'Constant'; Marriage-rates 'Intermediate 1942–47', Fertility '5 per cent. above 1935–38'; Net Migration Nil*)*

A. PERSONS IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	3,971	3,239	3,105	3,357	3,531	3,646	3,650	3,839	3,666	3,323	2,894	2,624	2,318	1,968	1,490	919	450	198	48,188
1952	3,798	3,922	3,221	3,083	3,321	3,488	3,599	3,599	3,769	3,571	3,196	2,729	2,400	2,019	1,585	1,052	525	254	49,131
1957	3,366	3,752	3,901	3,200	3,052	3,280	3,442	3,548	3,533	3,672	3,433	3,013	2,499	2,093	1,627	1,121	602	300	49,434
1962	3,163	3,326	3,731	3,875	3,165	3,013	3,236	3,394	3,483	3,442	3,529	3,236	2,756	2,178	1,687	1,152	643	349	49,358
1967	3,108	3,125	3,308	3,707	3,833	3,126	2,974	3,191	3,332	3,393	3,309	3,327	2,958	2,400	1,757	1,194	662	377	49,081
1972	3,185	3,070	3,108	3,286	3,667	3,785	3,086	2,933	3,133	3,245	3,263	3,118	3,040	2,574	1,933	1,245	686	396	48,753
1977	3,241	3,146	3,054	3,087	3,250	3,621	3,736	3,041	2,878	3,052	3,120	3,073	2,850	2,645	2,071	1,367	717	411	48,360
1982	3,184	3,202	3,129	3,033	3,054	3,210	3,574	3,684	2,986	2,804	2,933	2,939	2,809	2,480	2,129	1,463	786	427	47,826
1987	3,067	3,145	3,184	3,109	3,001	3,016	3,169	3,524	3,618	2,909	2,695	2,763	2,686	2,444	1,995	1,503	839	462	47,129
1992	2,961	3,030	3,128	3,163	3,076	2,963	2,977	3,124	3,460	3,524	2,797	2,540	2,525	2,338	1,965	1,409	861	494	46,335
1997	2,901	2,925	3,013	3,108	3,129	3,037	2,925	2,935	3,066	3,370	3,386	2,634	2,320	2,196	1,880	1,387	808	510	45,530
2002	2,877	2,865	2,909	2,993	3,075	3,090	2,998	2,884	2,882	2,987	3,239	3,189	2,407	2,018	1,766	1,326	795	493	44,793
2007	2,857	2,843	2,849	2,890	2,961	3,036	3,050	2,955	2,831	2,807	2,871	3,052	2,915	2,092	1,622	1,244	759	480	44,114
2012	2,814	2,822	2,827	2,831	2,859	2,924	2,997	3,007	2,901	2,757	2,698	2,706	2,788	2,533	1,682	1,144	712	462	43,464
2017	2,752	2,780	2,807	2,809	2,801	2,823	2,887	2,954	2,953	2,826	2,651	2,543	2,471	2,424	2,036	1,186	654	435	42,792
2022	2,688	2,718	2,764	2,788	2,778	2,766	2,787	2,846	2,900	2,875	2,717	2,498	2,322	2,149	1,949	1,435	679	402	42,061
2027	2,636	2,655	2,703	2,746	2,759	2,744	2,730	2,747	2,794	2,825	2,764	2,560	2,281	2,019	1,728	1,373	820	402	41,286
2032	2,598	2,605	2,640	2,685	2,717	2,724	2,709	2,691	2,698	2,721	2,716	2,604	2,338	1,984	1,623	1,218	786	468	40,525
2037	2,558	2,566	2,591	2,623	2,656	2,683	2,689	2,670	2,643	2,627	2,616	2,559	2,379	2,033	1,594	1,144	697	472	39,800
2042	2,518	2,527	2,552	2,573	2,596	2,623	2,648	2,651	2,622	2,573	2,525	2,465	2,338	2,069	1,634	1,124	655	433	39,126
2047	2,473	2,488	2,514	2,536	2,546	2,563	2,589	2,611	2,602	2,553	2,474	2,379	2,251	2,032	1,663	1,153	643	400	38,470

*For a fuller definition of the assumptions, see paras 5–18 of the report above

B. MALES IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	2,034	1,648	1,575	1,700	1,771	1,819	1,810	1,898	1,801	1,580	1,317	1,194	1,033	867	648	380	167	62	23,304
1952	1,933	2,007	1,637	1,563	1,681	1,748	1,794	1,782	1,859	1,747	1,507	1,222	1,066	869	668	430	197	80	23,790
1957	1,714	1,908	1,995	1,626	1,546	1,658	1,723	1,765	1,745	1,803	1,665	1,399	1,092	898	669	443	223	95	23,967
1962	1,610	1,692	1,896	1,981	1,607	1,525	1,635	1,697	1,729	1,692	1,718	1,546	1,249	919	692	444	231	110	23,973
1967	1,582	1,589	1,682	1,883	1,958	1,586	1,504	1,610	1,662	1,677	1,613	1,596	1,381	1,051	708	458	231	115	23,886
1972	1,621	1,561	1,579	1,670	1,861	1,932	1,564	1,481	1,577	1,611	1,599	1,498	1,425	1,162	810	470	238	117	23 776
1977	1 651	1,600	1,552	1,568	1,650	1,836	1,905	1,539	1,450	1,529	1,536	1,484	1,338	1,199	895	537	245	120	23,634
1982	1,621	1,629	1,590	1,541	1,550	1,628	1,811	1,876	1,508	1,406	1,457	1,426	1,326	1,126	924	594	280	123	23,416
1987	1,561	1,600	1,619	1,579	1,523	1,529	1,606	1,783	1,838	1,463	1,341	1,353	1,274	1,116	868	613	309	137	23,112
1992	1,508	1,541	1,590	1,607	1,561	1,503	1,508	1,581	1,746	1,782	1,394	1,245	1,209	1,073	859	575	319	152	22,753
1997	1,477	1,488	1,531	1,579	1,589	1,540	1,482	1,485	1,548	1,693	1,698	1,294	1,112	1,017	826	570	300	159	22,388
2002	1,465	1,457	1,479	1,520	1,561	1,568	1,519	1,459	1,454	1,501	1,614	1,577	1,156	936	784	548	297	154	22,049
2007	1,454	1,446	1,448	1,468	1,503	1,540	1,546	1,495	1,429	1,410	1,431	1,499	1,409	973	721	519	285	150	21,726
2012	1,433	1,435	1,437	1,438	1,451	1,483	1,519	1,522	1,464	1,385	1,344	1,330	1,339	1,186	749	478	270	145	21,408
2017	1,401	1,414	1,426	1,427	1,422	1,432	1,463	1,495	1,491	1,420	1,321	1,249	1,187	1,127	913	497	249	139	21,073
2022	1,369	1,382	1,405	1,416	1,410	1,403	1,412	1,440	1,464	1,445	1,354	1,227	1,115	999	868	606	259	129	20,703
2027	1,342	1,350	1,374	1,395	1,400	1,392	1,383	1,390	1,410	1,420	1,378	1,258	1,095	938	770	575	315	129	20,314
2032	1,323	1,325	1,342	1,364	1,379	1,381	1,373	1,362	1,362	1,367	1,354	1,280	1,123	922	723	510	300	153	19,943
2037	1,303	1,305	1,317	1,333	1,348	1,361	1,362	1,351	1,334	1,320	1,304	1,258	1,143	945	710	479	266	152	19,591
2042	1,282	1,286	1,297	1,307	1,318	1,330	1,342	1,341	1,324	1,293	1,259	1,211	1,123	962	728	471	250	139	19,263
2047	1,259	1,265	1,278	1,288	1,292	1,300	1,312	1,321	1,313	1,283	1,233	1,169	1,081	945	741	483	245	128	18,936

C. FEMALES IN QUINQUENNIAL AGF-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	1,937	1,591	1,530	1,657	1,760	1,827	1,840	1,941	1,865	1,743	1,577	1,430	1,285	1,101	842	539	283	136	24,884
1952	1,865	1,915	1,584	1,520	1,640	1,740	1,805	1,817	1,910	1,824	1,689	1,507	1,334	1,150	917	622	328	174	25,341
1957	1,652	1,844	1,906	1,574	1,506	1,622	1,719	1,783	1,788	1 869	1,768	1,614	1,407	1,195	958	678	379	205	25,467
1962	1,553	1,634	1,835	1,894	1,558	1,488	1,601	1,697	1,754	1,750	1,811	1,690	1,507	1,259	995	708	412	239	25,385
1967	1,526	1,536	1,626	1,824	1,875	1,540	1,470	1,581	1,670	1,716	1,696	1,731	1,577	1,349	1,049	736	431	262	25,195
1972	1,564	1,509	1,529	1,616	1,806	1,853	1,522	1,452	1,556	1,634	1,664	1,620	1,615	1,412	1,123	775	448	279	24,977
1977	1,590	1,546	1,502	1,519	1,600	1,785	1,831	1,502	1,428	1,523	1,584	1,589	1,512	1,446	1,176	830	472	291	24,726
1982	1,563	1,573	1,539	1,492	1,504	1,582	1,763	1,808	1,478	1,398	1,476	1,513	1,483	1,354	1,205	869	506	304	24,410
1987	1,506	1,545	1,565	1,530	1,478	1,487	1,563	1,741	1,780	1,446	1,354	1,410	1,412	1,328	1,127	890	530	325	24,017
1992	1,453	1,489	1,538	1,556	1,515	1,460	1,469	1,543	1,714	1,742	1,403	1,295	1,316	1,265	1,106	834	542	342	23,582
1997	1,424	1,437	1,482	1,529	1,540	1,497	1,443	1,450	1,518	1,677	1,688	1,340	1,208	1,179	1,054	817	508	351	23,142
2002	1,412	1,408	1,430	1,473	1,514	1,522	1,479	1,425	1,428	1,486	1,625	1,612	1,251	1,082	982	778	498	339	22,744
2007	1,403	1,397	1,401	1,422	1,458	1,496	1,504	1,460	1,402	1,397	1,440	1,553	1,506	1,119	901	725	474	330	22,388
2012	1,381	1,387	1,390	1,393	1,408	1,441	1,478	1,485	1,437	1,372	1,354	1,376	1,449	1,347	933	666	442	317	22,056
2017	1,351	1,366	1,381	1,382	1,379	1,391	1,424	1,459	1,462	1,406	1,330	1,294	1,284	1,297	1,123	689	405	296	21,719
2022	1,319	1,336	1,359	1,372	1,368	1,363	1,375	1,406	1,436	1,430	1,363	1,271	1,207	1,150	1,081	829	420	273	21,358
2027	1,294	1,305	1,329	1,351	1,359	1,352	1,347	1,357	1,384	1,405	1,386	1,302	1,186	1,081	958	798	505	273	20,972
2032	1,275	1,280	1,298	1,321	1,338	1,343	1,336	1,329	1,336	1,354	1,362	1,324	1,215	1,062	900	708	486	315	20,582
2037	1,255	1,261	1,274	1,290	1,308	1,322	1,327	1,319	1 309	1,307	1,312	1,301	1,236	1,088	884	665	431	320	20,209
2042	1,236	1,241	1,255	1,266	1,278	1,293	1,306	1,310	1,298	1,280	1,266	1,254	1,215	1,107	906	653	405	294	19,863
2047	1,214	1,223	1,236	1,248	1,254	1,263	1,277	1,290	1,289	1,270	1,241	1,210	1,170	1,087	922	670	398	272	19,534

PROJECTION 7

(Assumptions: *Mortality* ' *Declining* '; *Marriage-rates* ' *Intermediate 1942–47* '; *Fertility* ' *1935–38* '; *Net Migration Nil*)*

A. PERSONS IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	3,971	3,239	3,105	3,357	3,531	3,646	3,650	3,839	3,666	3,323	2,894	2,624	2,318	1,968	1,490	919	450	198	48,188
1952	3,830	3,930	3,223	3,085	3,325	3,491	3,605	3,604	3,777	3,585	3,205	2,743	2,417	2,036	1,602	1,053	529	256	49,296
1957	3,256	3,794	3,913	3,204	3,056	3,289	3,454	3,564	3,551	3,700	3,467	3,047	2,539	2,134	1,670	1,142	613	311	49,704
1962	3,077	3,229	3,780	3,892	3,176	3,027	3,256	3,418	3,517	3,485	3,586	3,306	2,831	2,255	1,764	1,203	675	365	49,842
1967	3,041	3,055	3,217	3,760	3,859	3,146	3,000	3,226	3,377	3,456	3,385	3,428	3,082	2,526	1,879	1,280	718	417	49,852
1972	3,141	3,021	3,045	3,201	3,730	3,825	3,121	2,974	3,190	3,325	3,364	3,245	3,207	2,760	2,115	1,376	773	455	49,868
1977	3,206	3,122	3,013	3,031	3,177	3,700	3,797	3,097	2,945	3,144	3,243	3,233	3,045	2,886	2,324	1,558	838	497	49,856
1982	3,149	3,189	3,114	3,001	3,009	3,153	3,675	3,770	3,068	2,907	3,072	3,122	3,045	2,751	2,445	1,727	952	548	49,697
1987	3,019	3,132	3,181	3,101	2,979	2,987	3,131	3,648	3,735	3,028	2,839	2,958	2,941	2,750	2,331	1,816	1,052	613	49,241
1992	2,910	3,002	3,124	3,167	3,079	2,956	2,967	3,109	3,615	3,687	2,959	2,734	2,784	2,657	2,329	1,731	1,106	683	48,599
1997	2,855	2,894	2,995	3,110	3,145	3,055	2,937	2,945	3,080	3,568	3,602	2,849	2,573	2,515	2,249	1,730	1,054	728	47,884
2002	2,837	2,840	2,887	2,982	3,088	3,120	3,034	2,915	2,918	3,040	3,485	3,469	2,681	2,325	2,129	1,668	1,052	716	47,186
2007	2,817	2,822	2,832	2,875	2,961	3,065	3,099	3,013	2,889	2,880	2,970	3,356	3,265	2,422	1,967	1,577	1,016	706	46,532
2012	2,773	2,802	2,814	2,820	2,854	2,939	3,044	3,077	2,985	2,851	2,814	2,860	3,159	2,947	2,049	1,458	960	686	45,892
2017	2,711	2,758	2,795	2,803	2,799	2,832	2,918	3,022	3,049	2,946	2,785	2,710	2,692	2,853	2,492	1,519	887	651	45,222
2022	2,648	2,697	2,751	2,783	2,782	2,779	2,813	2,898	2,995	3,008	2,878	2,682	2,550	2,431	2,414	1,846	924	607	44,486
2027	2,600	2,633	2,690	2,739	2,763	2,761	2,760	2,793	2,871	2,955	2,940	2,771	2,525	2,303	2,057	1,789	1,122	610	43,682
2032	2,560	2,585	2,627	2,678	2,719	2,742	2,742	2,739	2,768	2,833	2,886	2,830	2,608	2,279	1,948	1,524	1,087	709	42,864
2037	2,523	2,547	2,579	2,616	2,659	2,698	2,723	2,723	2,714	2,731	2,768	2,779	2,664	2,355	1,928	1,444	927	726	42,104
2042	2,480	2,509	2,540	2,568	2,597	2,639	2,681	2,704	2,698	2,679	2,668	2,666	2,617	2,405	1,993	1,429	878	650	41,401
2047	2,436	2,467	2,503	2,529	2,549	2,577	2,621	2,661	2,680	2,662	2,617	2,569	2,509	2,363	2,035	1,476	869	601	40,724

* For a fuller definition of the assumptions, see paras. 5–18 of the report above.

B. MALES IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	2,034	1,648	1,575	1,700	1,771	1,819	1,810	1,898	1,801	1,580	1,317	1,194	1,033	867	648	380	167	62	23,304
1952	1,950	2,010	1,639	1,564	1,683	1,750	1,797	1,785	1,863	1,754	1,511	1,230	1,074	879	674	430	198	81	23,872
1957	1,659	1,929	2,000	1,628	1,548	1,663	1,730	1,775	1,755	1,818	1,682	1,417	1,112	918	688	449	225	100	24,096
1962	1,569	1,643	1,921	1,988	1,613	1,532	1,646	1,711	1,748	1,716	1,748	1,583	1,287	956	724	462	237	113	24,197
1967	1,551	1,556	1,636	1,910	1,970	1,597	1,518	1,630	1,687	1,712	1,654	1,649	1,444	1,113	759	488	245	126	24,245
1972	1,602	1,539	1,550	1,627	1,894	1,952	1,584	1,504	1,609	1,656	1,654	1,566	1,510	1,254	889	516	261	133	24,300
1977	1,636	1,591	1,534	1,542	1,614	1,878	1,937	1,571	1,487	1,581	1,604	1,570	1,439	1,318	1,008	608	277	142	24,337
1982	1,608	1,626	1,586	1,527	1,530	1,601	1,865	1,922	1,554	1,463	1,534	1,526	1,449	1,261	1,066	693	328	153	24,292
1987	1,541	1,598	1,621	1,579	1,515	1,518	1,590	1,851	1,901	1,529	1,420	1,460	1,408	1,270	1,020	733	374	177	24,105
1992	1,486	1,531	1,593	1,613	1,567	1,503	1,508	1,578	1,831	1,872	1,485	1,351	1,347	1,235	1,027	702	396	205	23,830
1997	1,458	1,476	1,527	1,585	1,601	1,554	1,493	1,496	1,561	1,802	1,816	1,413	1,246	1,181	998	707	379	221	23,514
2002	1,449	1,449	1,472	1,519	1,573	1,588	1,543	1,481	1,480	1,536	1,749	1,729	1,303	1,093	955	686	381	218	23,204
2007	1,438	1,440	1,444	1,465	1,508	1,561	1,577	1,532	1,466	1,457	1,491	1,664	1,595	1,143	884	656	371	216	22,908
2012	1,416	1,429	1,435	1,437	1,454	1,496	1,550	1,565	1,515	1,442	1,414	1,419	1,535	1,398	924	608	355	212	22,604
2017	1,385	1,407	1,425	1,429	1,426	1,442	1,485	1,538	1,548	1,491	1,400	1,346	1,309	1,346	1,130	636	329	203	22,275
2022	1,352	1,376	1,403	1,418	1,417	1,415	1,432	1,474	1,522	1,523	1,447	1,332	1,241	1,148	1,089	777	344	189	21,899
2027	1,328	1,343	1,372	1,396	1,407	1,406	1,405	1,421	1,458	1,497	1,479	1,377	1,229	1,088	928	749	420	192	21,495
2032	1,307	1,319	1,339	1,365	1,385	1,396	1,396	1,394	1,406	1,435	1,453	1,407	1,270	1,077	880	638	404	226	21,097
2037	1,288	1,299	1,315	1,333	1,355	1,374	1,386	1,386	1,379	1,383	1,393	1,383	1,298	1,114	871	605	345	230	20,737
2042	1,267	1,280	1,295	1,309	1,323	1,344	1,365	1,376	1,371	1,357	1,343	1,326	1,276	1,138	901	599	327	204	20,401
2047	1,244	1,259	1,276	1,289	1,299	1,312	1,335	1,354	1,361	1,349	1,317	1,278	1,223	1,119	920	619	324	189	20,067

C. FEMALES IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	1,937	1,591	1,530	1,657	1,760	1,827	1,840	1,941	1,865	1,743	1,577	1,430	1,285	1,101	842	539	283	136	24,884
1952	1,880	1,920	1,584	1,521	1,642	1,741	1,808	1,819	1,914	1,831	1,694	1,513	1,343	1,157	928	623	331	175	25,424
1957	1,597	1,865	1,913	1,576	1,508	1,626	1,724	1,789	1,796	1,882	1,785	1,630	1,427	1,216	982	693	388	211	25,608
1962	1,508	1,586	1,859	1,904	1,563	1,495	1,610	1,707	1,769	1,769	1,838	1,723	1,544	1,299	1,040	741	438	252	25,645
1967	1,490	1,499	1,581	1,850	1,889	1,549	1,482	1,596	1,690	1,744	1,731	1,779	1,638	1,413	1,120	792	473	291	25,607
1972	1,539	1,482	1,495	1,574	1,836	1,873	1,537	1,470	1,581	1,669	1,710	1,679	1,697	1,506	1,226	860	512	322	25,568
1977	1,570	1,531	1,479	1,489	1,563	1,822	1,860	1,526	1,458	1,563	1,639	1,663	1,606	1,568	1,316	950	561	355	25,519
1982	1,541	1,563	1,528	1,474	1,479	1,552	1,810	1,848	1,514	1,444	1,538	1,596	1,596	1,490	1,379	1,034	624	395	25,405
1987	1,478	1,534	1,560	1,522	1,464	1,469	1,541	1,797	1,834	1,499	1,419	1,498	1,533	1,480	1,311	1,083	678	436	25,136
1992	1,424	1,471	1,531	1,554	1,512	1,453	1,459	1,531	1,784	1,815	1,474	1,383	1,437	1,422	1,302	1,029	710	478	24,769
1997	1,397	1,418	1,468	1,525	1,544	1,501	1,444	1,449	1,519	1,766	1,786	1,436	1,327	1,334	1,251	1,023	675	507	24,370
2002	1,388	1,391	1,415	1,463	1,515	1,532	1,491	1,434	1,438	1,504	1,736	1,740	1,378	1,232	1,174	982	671	498	23,982
2007	1,379	1,382	1,388	1,410	1,453	1,504	1,522	1,481	1,423	1,423	1,479	1,692	1,670	1,279	1,083	921	645	490	23,624
2012	1,357	1,373	1,379	1,383	1,400	1,443	1,494	1,512	1,470	1,409	1,400	1,441	1,624	1,549	1,125	850	605	474	23,288
2017	1,326	1,351	1,370	1,374	1,373	1,390	1,433	1,484	1,501	1,455	1,385	1,364	1,383	1,507	1,362	883	558	448	22,947
2022	1,296	1,321	1,348	1,365	1,365	1,364	1,381	1,424	1,473	1,485	1,431	1,350	1,309	1,283	1,325	1,069	580	418	22,587
2027	1,272	1,290	1,318	1,343	1,356	1,355	1,355	1,372	1,413	1,458	1,461	1,394	1,296	1,215	1,129	1,040	702	418	22,187
2032	1,253	1,266	1,288	1,313	1,334	1,346	1,346	1,345	1,362	1,398	1,433	1,423	1,338	1,202	1,068	886	683	483	21,768
2037	1,235	1,248	1,264	1,283	1,304	1,324	1,337	1,337	1,335	1,348	1,375	1,396	1,366	1,241	1,057	839	582	496	21,367
2042	1,213	1,229	1,245	1,259	1,274	1,295	1,316	1,328	1,327	1,322	1,325	1,340	1,341	1,267	1,092	830	551	446	21,000
2047	1,192	1,208	1,227	1,240	1,250	1,265	1,286	1,307	1,319	1,313	1,300	1,291	1,286	1,244	1,115	857	545	412	20,657

PROJECTION 8

(Assumptions: *Mortality ' Declining ', Marriage-rates ' Intermediate 1942–47 '; Fertility ' 5 per cent. above 1935–38 '; Net Migration Nil)**

A. PERSONS IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	3,971	3,239	3,105	3,357	3,531	3,646	3,650	3,839	3,666	3,323	2,894	2,624	2,318	1,968	1,490	919	450	198	48,188
1952	3,832	3 930	3,223	3,085	3,325	3,491	3,605	3,604	3,777	3,585	3,205	2,743	2,417	2,036	1,602	1,053	529	256	49,298
1957	3,419	3,796	3,913	3,204	3,056	3,289	3,454	3,564	3,551	3,700	3,467	3,047	2,539	2,134	1,670	1,142	613	311	49,869
1962	3,231	3,390	3,782	3,892	3,176	3,027	3,256	3,418	3,517	3,485	3,586	3,306	2,831	2,255	1,764	1,203	675	365	50,159
1967	3,193	3,207	3,378	3,762	3,859	3,146	3,000	3,226	3,377	3,456	3,385	3,428	3,082	2,526	1,879	1,280	718	417	50,319
1972	3,296	3,171	3,197	3,362	3,732	3,825	3,121	2,974	3,190	3,325	3,364	3,245	3,207	2,760	2,115	1,376	773	455	50,488
1977	3,386	3,276	3,162	3,183	3,336	3,702	3,797	3,097	2,945	3,144	3,243	3,233	3,045	2,886	2,324	1,558	838	497	50,652
1982	3,361	3,369	3,267	3,149	3,159	3,310	3,677	3,770	3,068	2,907	3,072	3,122	3,045	2,751	2,445	1,727	952	548	50,699
1987	3,261	3,343	3,359	3,254	3,126	3,136	3,288	3,651	3,735	3,028	2,839	2,958	2,941	2,750	2,331	1,816	1,052	613	50,481
1992	3,171	3,244	3,335	3,345	3,230	3,103	3,115	3,264	3,618	3,687	2,959	2,734	2,784	2,657	2,329	1,731	1,106	683	50,095
1997	3,130	3,154	3,236	3,320	3,321	3,205	3,082	3,092	3,234	3,570	3,602	2,849	2,573	2,515	2,249	1,730	1,054	728	49,644
2002	3,130	3,113	3,146	3,222	3,297	3,296	3,184	3,060	3,064	3,192	3,488	3,469	2,681	2,325	2,129	1,668	1,052	716	49,232
2007	3,131	3,113	3,105	3,133	3,198	3,271	3,274	3,161	3,031	3,024	3,118	3,358	3,265	2,422	1,967	1,577	1,016	706	48,870
2012	3,107	3,114	3,105	3,092	3,110	3,174	3,249	3,250	3,133	2,991	2,954	3,003	3,162	2,947	2,049	1,458	960	686	48,544
2017	3,063	3,090	3,106	3,092	3,070	3,086	3,153	3,226	3,221	3,091	2,922	2,844	2,826	2,855	2,492	1,519	887	651	48,194
2022	3,016	3,048	3,082	3,093	3,070	3,046	3,065	3,130	3,197	3,178	3,020	2,814	2,678	2,552	2,415	1,846	924	607	47,781
2027	2,981	3,001	3,040	3,069	3,071	3,046	3,025	3,043	3,102	3,155	3,105	2,908	2,649	2,417	2,159	1,790	1,122	610	47,293
2032	2,959	2,965	2,993	3,026	3,047	3,047	3,025	3,004	3,016	3,061	3,082	2,990	2,737	2,391	2,046	1,600	1,089	709	46,787
2037	2,937	2,943	2,957	2,979	3,004	3,024	3,026	3,004	2,977	2,976	2,990	2,967	2,814	2,471	2,023	1,516	973	726	46,307
2042	2,912	2,921	2,935	2,945	2,958	2,982	3,003	3,005	2,977	2,937	2,907	2,879	2,793	2,540	2,090	1,499	921	674	45,878
2047	2,883	2,896	2,914	2,923	2,924	2,936	2,962	2,982	2,978	2,937	2,869	2,799	2,710	2,522	2,149	1,549	911	628	45,472

* For a fuller definition of the assumptions, see paras 5–18 of the report above.

B. MALES IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	2,034	1,648	1,575	1,700	1,771	1,819	1,810	1,898	1,801	1,580	1,317	1,194	1,033	867	648	380	167	62	23,304
1952	1,951	2,010	1,639	1,564	1,683	1,750	1,797	1,785	1,863	1,754	1,511	1,230	1,074	879	674	430	198	81	23,873
1957	1,742	1,930	2,000	1,628	1,548	1,663	1,730	1,775	1,755	1,818	1,682	1,417	1,112	918	688	449	225	100	24,180
1962	1,647	1,725	1,922	1,988	1,613	1,532	1,646	1,711	1,748	1,716	1,748	1,583	1,287	956	724	462	237	113	24,358
1967	1,629	1,633	1,718	1,911	1,970	1,597	1,518	1,630	1,687	1,712	1,654	1,649	1,444	1,113	759	488	245	126	24,483
1972	1,682	1,616	1,627	1,709	1,895	1,952	1,584	1,504	1,609	1,656	1,654	1,566	1,510	1,254	889	516	261	133	24,617
1977	1,728	1,670	1,611	1,619	1,695	1,879	1,937	1,571	1,487	1,581	1,604	1,570	1,439	1,318	1,008	608	277	142	24,744
1982	1,716	1,718	1,665	1,604	1,606	1,681	1,866	1,922	1,554	1,463	1,534	1,526	1,449	1,261	1,066	693	328	153	24,805
1987	1,665	1,705	1,712	1,657	1,591	1,594	1,670	1,852	1,901	1,529	1,420	1,460	1,408	1,270	1,020	733	374	177	24,738
1992	1,619	1,655	1,700	1,704	1,644	1,579	1,583	1,657	1,832	1,872	1,485	1,351	1,347	1,235	1,027	702	396	205	24,593
1997	1,598	1,609	1,650	1,692	1,691	1,631	1,568	1,571	1,639	1,803	1,816	1,413	1,246	1,181	998	707	379	221	24,413
2002	1,598	1,588	1,604	1,642	1,679	1,678	1,620	1,556	1,554	1,613	1,750	1,729	1,303	1,093	955	686	381	218	24,247
2007	1,598	1,588	1,583	1,596	1,629	1,665	1,666	1,608	1,539	1,529	1,565	1,665	1,595	1,143	884	656	371	216	24,096
2012	1,587	1,588	1,583	1,576	1,584	1,616	1,654	1,653	1,591	1,514	1,484	1,490	1,536	1,398	924	608	355	212	23,953
2017	1,564	1,577	1,583	1,576	1,564	1,571	1,605	1,641	1,636	1,565	1,470	1,412	1,374	1,347	1,130	636	329	203	23,783
2022	1,540	1,555	1,572	1,576	1,564	1,551	1,560	1,593	1,624	1,609	1,519	1,399	1,303	1,205	1,089	777	344	189	23,569
2027	1,522	1,531	1,550	1,564	1,564	1,551	1,540	1,548	1,576	1,598	1,562	1,446	1,290	1,142	974	749	420	192	23,319
2032	1,511	1,512	1,526	1,542	1,552	1,551	1,540	1,529	1,532	1,551	1,551	1,487	1,333	1,131	924	670	405	226	23,073
2037	1,499	1,502	1,507	1,518	1,530	1,540	1,540	1,529	1,513	1,507	1,505	1,476	1,371	1,169	915	635	362	230	22,848
2042	1,487	1,490	1,497	1,500	1,507	1,518	1,529	1,529	1,513	1,488	1,463	1,432	1,361	1,202	945	629	343	212	22,645
2047	1,472	1,477	1,485	1,490	1,489	1,495	1,508	1,518	1,513	1,488	1,444	1,392	1,321	1,194	972	650	340	198	22,446

C. FEMALES IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	1,937	1,591	1,530	1,657	1,760	1,827	1,840	1,941	1,865	1,743	1,577	1,430	1,285	1,101	842	539	283	136	24,884
1952	1,881	1,920	1,584	1,521	1,642	1,741	1,808	1,819	1,914	1,831	1,694	1,513	1,343	1,157	928	623	331	175	25,425
1957	1,677	1,866	1,913	1,576	1,508	1,626	1,724	1,789	1,796	1,882	1,785	1,630	1,427	1,216	982	693	388	211	25,689
1962	1,584	1,665	1,860	1,904	1,563	1,495	1,610	1,707	1,769	1,769	1,838	1,723	1,544	1,299	1,040	741	438	252	25,801
1967	1,564	1,574	1,660	1,851	1,889	1,549	1,482	1,596	1,690	1,744	1,731	1,779	1,638	1,413	1,120	792	473	291	25,836
1972	1,614	1,555	1,570	1,653	1,837	1,873	1,537	1,470	1,581	1,669	1,710	1,679	1,697	1,506	1,226	860	512	322	25,871
1977	1,658	1,606	1,551	1,564	1,641	1,823	1,860	1,526	1,458	1,563	1,639	1,663	1,606	1,568	1,316	950	561	355	25,908
1982	1,645	1,651	1,602	1,545	1,553	1,629	1,811	1,848	1,514	1,444	1,538	1,596	1,596	1,490	1,379	1,034	624	395	25,894
1987	1,596	1,638	1,647	1,597	1,535	1,542	1,618	1,799	1,834	1,499	1,419	1,498	1,533	1,480	1,311	1,083	678	436	25,743
1992	1,552	1,589	1,635	1,641	1,586	1,524	1,532	1,607	1,786	1,815	1,474	1,383	1,437	1,422	1,302	1,029	710	478	25,502
1997	1,532	1,545	1,586	1,628	1,630	1,574	1,514	1,521	1,595	1,767	1,786	1,436	1,327	1,334	1,251	1,023	675	507	25,231
2002	1,532	1,525	1,542	1,580	1,618	1,618	1,564	1,504	1,510	1,579	1,738	1,740	1,378	1,232	1,174	982	671	498	24,985
2007	1,533	1,525	1,522	1,537	1,569	1,606	1,608	1,553	1,492	1,495	1,553	1,693	1,670	1,279	1,083	921	645	490	24,774
2012	1,520	1,526	1,522	1,516	1,526	1,558	1,595	1,597	1,542	1,477	1,470	1,513	1,626	1,549	1,125	850	605	474	24,591
2017	1,499	1,513	1,523	1,516	1,506	1,515	1,548	1,585	1,585	1,526	1,452	1,432	1,452	1,508	1,362	883	558	448	24,411
2022	1,476	1,493	1,510	1,517	1,506	1,495	1,505	1,537	1,573	1,569	1,501	1,415	1,375	1,347	1,326	1,069	580	418	24,212
2027	1,459	1,470	1,490	1,505	1,507	1,495	1,485	1,495	1,526	1,557	1,543	1,462	1,359	1,275	1,185	1,041	702	418	23,974
2032	1,448	1,453	1,467	1,484	1,495	1,496	1,485	1,475	1,484	1,510	1,531	1,503	1,404	1,260	1,122	930	684	483	23,714
2037	1,438	1,441	1,450	1,461	1,474	1,484	1,486	1,475	1,464	1,469	1,485	1,491	1,443	1,302	1,108	881	611	496	23,459
2042	1,425	1,431	1,438	1,445	1,451	1,464	1,474	1,476	1,464	1,449	1,444	1,447	1,432	1,338	1,145	870	578	462	23,233
2047	1,411	1,419	1,429	1,433	1,435	1,441	1,454	1,464	1,465	1,449	1,425	1,407	1,389	1,328	1,177	899	571	430	23,026

PROJECTION 9

(Assumptions: *Mortality 'Declining', Marriage-rates 'Intermediate 1942–47', Fertility 'Exact Replacement', Net Migration Nil*)*

A. PERSONS IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	3,971	3,239	3,105	3,357	3,531	3,646	3,650	3,839	3,666	3,323	2,894	2,624	2,318	1,968	1,490	919	450	198	48,188
1952	3,904	3,930	3,223	3,085	3,325	3,491	3,605	3,604	3,777	3,585	3,205	2,743	2,417	2,036	1,602	1,053	529	256	49,370
1957	3,635	3,868	3,913	3,204	3,056	3,289	3,454	3,564	3,551	3,700	3,467	3,047	2,539	2,134	1,670	1,142	613	311	50,157
1962	3,437	3,604	3,853	3,892	3,176	3,027	3,256	3,418	3,517	3,485	3,586	3,306	2,831	2,255	1,764	1,203	675	365	50,650
1967	3,395	3,411	3,592	3,833	3,859	3,146	3,000	3,226	3,377	3,456	3,385	3,428	3,082	2,526	1,879	1,280	718	417	51,010
1972	3,516	3,373	3,401	3,574	3,802	3,825	3,121	2,974	3,190	3,325	3,364	3,245	3,207	2,760	2,115	1,376	773	455	51,396
1977	3,644	3,495	3,363	3,385	3,547	3,771	3,797	3,097	2,945	3,144	3,243	3,233	3,045	2,886	2,324	1,558	838	497	51,812
1982	3,673	3,625	3,486	3,349	3,361	3,521	3,746	3,770	3,068	2,907	3,072	3,122	3,045	2,751	2,445	1,727	952	548	52,168
1987	3,615	3,653	3,615	3,471	3,325	3,335	3,496	3,718	3,735	3,028	2,839	2,958	2,941	2,750	2,331	1,816	1,052	613	52,291
1992	3,552	3,595	3,643	3,600	3,446	3,299	3,313	3,472	3,685	3,687	2,959	2,734	2,784	2,657	2,329	1,731	1,106	683	52,275
1997	3,535	3,532	3,587	3,628	3,574	3,420	3,277	3,289	3,440	3,636	3,602	2,849	2,573	2,515	2,249	1,730	1,054	728	52,218
2002	3,561	3,517	3,524	3,571	3,601	3,547	3,396	3,254	3,259	3,395	3,552	3,469	2,681	2,325	2 129	1,668	1,052	716	52,217
2007	3,596	3,541	3,507	3,508	3,546	3,575	3,523	3,372	3,225	3,216	3,317	3,420	3,265	2,422	1,967	1,577	1,016	706	52,299
2012	3,607	3,577	3,533	3,493	3,483	3,518	3,550	3,497	3,342	3,181	3,142	3,193	3,219	2,947	2,049	1,458	960	686	52,435
2017	3,596	3,588	3,567	3,517	3,467	3,457	3,495	3,524	3,466	3,298	3,108	3,025	3,006	2,908	2,492	1,519	887	651	52,571
2022	3,579	3,578	3,579	3,552	3,492	3,441	3,433	3,469	3,493	3,420	3,222	2,992	2,848	2,714	2,460	1,846	924	607	52,649
2027	3,574	3,560	3,568	3,563	3,526	3,465	3,418	3,409	3,438	3,447	3,341	3,103	2,817	2,572	2,296	1,823	1,122	610	52,652
2032	3,578	3,554	3,550	3,553	3,538	3,500	3,442	3,392	3,378	3,393	3,367	3,217	2,920	2,544	2,176	1,703	1,108	709	52,622
2037	3,587	3,559	3,544	3,536	3,527	3,511	3,476	3,418	3,362	3,333	3,314	3,243	3,029	2,637	2,152	1,613	1,035	735	52,611
2042	3,592	3,568	3,549	3,530	3,510	3,501	3,487	3,451	3,386	3,318	3,256	3,192	3,051	2,734	2,231	1,595	980	705	52,636
2047	3,590	3,573	3,558	3,535	3,504	3,484	3,477	3,462	3,420	3,341	3,241	3,135	3,004	2,755	2,313	1,653	969	667	52,681

* For a fuller definition of the assumptions, see paras 5–18 of the report above

B. MALES IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	2,034	1,648	1,575	1,700	1,771	1,819	1,810	1,898	1,801	1,580	1,317	1,194	1,033	867	648	380	167	62	23,304
1952	1,988	2,010	1,639	1,564	1,683	1,750	1,797	1,785	1,863	1,754	1,511	1,230	1,074	879	674	430	198	81	23,910
1957	1,852	1,967	2,000	1,628	1,548	1,663	1,730	1,775	1,755	1,818	1,682	1,417	1,112	918	688	449	225	100	24,327
1962	1,752	1,834	1,958	1,988	1,613	1,532	1,646	1,711	1,748	1 716	1,748	1,583	1,287	956	724	462	237	113	24,608
1967	1,732	1,737	1,827	1,947	1,970	1,597	1,518	1,630	1,687	1,712	1,654	1,649	1,444	1,113	759	488	245	126	24,835
1972	1,794	1,719	1,731	1,817	1,930	1,952	1,584	1,504	1,609	1,656	1,654	1,566	1,510	1,254	889	516	261	133	25,079
1977	1,860	1,782	1,713	1,722	1,802	1,914	1,937	1,571	1,487	1,581	1,604	1,570	1,439	1,318	1,008	608	277	142	25,335
1982	1,875	1,849	1,777	1,705	1,709	1,788	1,901	1,922	1,554	1,463	1,534	1,526	1,449	1,261	1,066	693	328	153	25,553
1987	1,846	1,863	1,843	1,768	1,692	1,695	1,775	1,886	1,901	1,529	1,420	1,460	1,408	1,270	1,020	733	374	177	25,660
1992	1,814	1,834	1,857	1,834	1,754	1,678	1,684	1,762	1,866	1,872	1,485	1,351	1,347	1,235	1,027	702	396	205	25,703
1997	1,805	1,802	1,829	1,849	1,820	1,741	1,667	1,671	1,743	1,836	1,816	1,413	1,246	1,181	998	707	379	221	25,724
2002	1,818	1,794	1,797	1,820	1,834	1,806	1,728	1,654	1,653	1,715	1,782	1,729	1,303	1,093	955	686	381	218	25,766
2007	1,836	1,806	1,788	1,788	1,806	1,820	1,793	1,715	1,637	1,626	1,665	1,696	1,595	1,143	884	656	371	216	25,841
2012	1,842	1,825	1,801	1,780	1,774	1,791	1,807	1,779	1,697	1,610	1,579	1,584	1,564	1,398	924	608	355	212	25,930
2017	1,836	1,830	1,819	1,792	1,766	1,760	1,779	1,793	1,761	1,670	1,563	1,502	1,461	1,372	1,130	636	329	203	26,002
2022	1,827	1,825	1,825	1,810	1,778	1,752	1,748	1,765	1,774	1,732	1,621	1,487	1,386	1,281	1,109	777	344	189	26,030
2027	1,825	1,816	1,819	1,816	1,796	1,764	1,740	1,735	1,747	1,746	1,681	1,543	1,372	1,215	1,036	763	420	192	26,026
2032	1,827	1,813	1,810	1,810	1,802	1,782	1,752	1,726	1,716	1,719	1,694	1,600	1,423	1,203	983	713	412	226	26,011
2037	1,831	1,816	1,807	1,802	1,796	1,788	1,770	1,739	1,708	1,689	1,668	1,613	1,476	1,248	973	676	385	233	26,018
2042	1,834	1,820	1,810	1,799	1,788	1,782	1,775	1,756	1,720	1,681	1,639	1,588	1,487	1,294	1,009	669	365	222	26,038
2047	1,833	1,823	1,814	1,802	1,785	1,774	1,770	1,762	1,738	1,692	1,631	1,560	1,464	1,304	1,046	694	361	211	26,064

C. FEMALES IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	1,937	1,591	1,530	1,657	1,760	1,827	1,840	1,941	1,865	1,743	1,577	1,430	1,285	1,101	842	539	283	136	24,884
1952	1,916	1,920	1,584	1,521	1,642	1,741	1,808	1,819	1,914	1,831	1,694	1,513	1,343	1,157	928	623	331	175	25,460
1957	1,783	1,901	1,913	1,576	1,508	1,626	1,724	1,789	1,796	1,882	1,785	1,630	1,427	1,216	982	693	388	211	25,830
1962	1,685	1,770	1,895	1,904	1,563	1,495	1,610	1,707	1,769	1,769	1,838	1,723	1,544	1,299	1,040	741	438	252	26,042
1967	1,663	1,674	1,765	1,886	1,889	1,549	1,482	1,596	1,690	1,744	1,731	1,779	1,638	1,413	1,120	792	473	291	26,175
1972	1,722	1,654	1,670	1,757	1,872	1,873	1,537	1,470	1,581	1,669	1,710	1,679	1,697	1,506	1,226	860	512	322	26,317
1977	1,784	1,713	1,650	1,663	1,745	1,857	1,860	1,526	1,458	1,563	1,639	1,663	1,606	1,568	1,316	950	561	355	26,477
1982	1,798	1,776	1,709	1,644	1,652	1,733	1,845	1,848	1,514	1,444	1,538	1,596	1,596	1,490	1,379	1,034	624	395	26,615
1987	1,769	1,790	1,772	1,703	1,633	1,640	1,721	1,832	1,834	1,499	1,419	1,498	1,533	1,480	1,311	1,083	678	436	26,631
1992	1,738	1,761	1,786	1,766	1,692	1,621	1,629	1,710	1,819	1,815	1,474	1,383	1,437	1,422	1,302	1,029	710	478	26,572
1997	1,730	1,730	1,758	1,779	1,754	1,679	1,610	1,618	1,697	1,800	1,786	1,436	1,327	1,334	1,251	1,023	675	507	26,494
2002	1,743	1,723	1,727	1,751	1,767	1,741	1,668	1,600	1,606	1,680	1,770	1,740	1,378	1,232	1,174	982	671	498	26,451
2007	1,760	1,735	1,719	1,720	1,740	1,755	1,730	1,657	1,588	1,590	1,652	1,724	1,670	1,279	1,083	921	645	490	26,458
2012	1,765	1,752	1,732	1,713	1,709	1,727	1,743	1,718	1,645	1,571	1,563	1,608	1,655	1,549	1,125	850	605	474	26,504
2017	1,760	1,758	1,748	1,725	1,701	1,697	1,716	1,731	1,705	1,628	1,545	1,523	1,545	1,536	1,362	883	558	448	26,569
2022	1,752	1,753	1,754	1,742	1,714	1,689	1,685	1,704	1,719	1,688	1,601	1,505	1,462	1,433	1,351	1,069	580	418	26,619
2027	1,749	1,744	1,749	1,747	1,730	1,701	1,678	1,674	1,691	1,701	1,660	1,560	1,445	1,357	1,260	1,060	702	418	26,626
2032	1,751	1,741	1,740	1,743	1,736	1,718	1,690	1,666	1,662	1,674	1,673	1,617	1,497	1,341	1,193	990	696	483	26,611
2037	1,756	1,743	1,737	1,734	1,731	1,723	1,706	1,679	1,654	1,644	1,646	1,630	1,553	1,389	1,179	937	650	502	26,593
2042	1,758	1,748	1,739	1,731	1,722	1,719	1,712	1,695	1,666	1,637	1,617	1,604	1,564	1,440	1,222	926	615	483	26,598
2047	1,757	1,750	1,744	1,733	1,719	1,710	1,707	1,700	1,682	1,649	1,610	1,575	1,540	1,451	1,267	959	608	456	26,617

PROJECTION 10

(Assumptions: *Mortality 'Declining', Marriage-rates 'Intermediate 1942–47', Fertility 'Falling', Net Migration Nil*)*

A. PERSONS IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	3,971	3,239	3,105	3,357	3,531	3,646	3,650	3,839	3,666	3,323	2,894	2,624	2,318	1,968	1,490	919	450	198	48,188
1952	3,831	3,930	3,223	3,085	3,325	3,491	3,605	3,604	3,777	3,585	3,205	2,743	2,417	2,036	1,602	1,053	529	256	49,297
1957	3,264	3,795	3,913	3,204	3,056	3,289	3,454	3,564	3,551	3,700	3,467	3,047	2,539	2,134	1,670	1,142	613	311	49,713
1962	2,944	3,237	3,781	3,892	3,176	3,027	3,256	3,418	3,517	3,485	3,586	3,306	2,831	2,255	1,764	1,203	675	365	49,718
1967	2,745	2,922	3,225	3,761	3,859	3,146	3,000	3,226	3,377	3,456	3,385	3,428	3,082	2,526	1,879	1,280	718	417	49,432
1972	2,716	2,727	2,912	3,209	3,731	3,825	3,121	2,974	3,190	3,325	3,364	3,245	3,207	2,760	2,115	1,376	773	455	49,025
1977	2,722	2,699	2,719	2,898	3,185	3,701	3,797	3,097	2,945	3,144	3,243	3,233	3,045	2,886	2,324	1,558	838	497	48,531
1982	2,640	2,707	2,692	2,708	2,878	3,160	3,676	3,770	3,068	2,907	3,072	3,122	3,045	2,751	2,445	1,727	952	548	47,868
1987	2,486	2,627	2,701	2,680	2,689	2,856	3,139	3,649	3,735	3,028	2,839	2,958	2,941	2,750	2,331	1,816	1,052	613	46,890
1992	2,325	2,473	2,619	2,689	2,661	2,668	2,836	3,117	3,616	3,687	2,959	2,734	2,784	2,657	2,329	1,731	1,106	683	45,674
1997	2,200	2,312	2,467	2,608	2,670	2,641	2,650	2,816	3,088	3,569	3,602	2,849	2,573	2,515	2,249	1,730	1,054	728	44,321
2002	2,114	2,188	2,306	2,456	2,590	2,650	2,623	2,632	2,791	3,048	3,486	3,649	2,681	2,325	2,129	1,668	1,052	716	42,924
2007	2,044	2,103	2,182	2,296	2,439	2,569	2,631	2,604	2,607	2,753	2,976	3,357	3,265	2,422	1,967	1,577	1,016	706	41,514
2012	1,964	2,034	2,098	2,173	2,280	2,420	2,552	2,612	2,581	2,573	2,690	2,866	3,160	2,947	2,049	1,458	960	686	40,103
2017	1,875	1,954	2,028	2,089	2,157	2,263	2,403	2,534	2,589	2,546	2,514	2,590	2,699	2,854	2,492	1,519	887	651	38,644
2022	1,783	1,865	1,949	2,020	2,074	2,142	2,247	2,386	2,511	2,555	2,487	2,420	2,438	2,436	2,414	1,846	924	607	37,104
2027	1,697	1,774	1,860	1,940	2,005	2,057	2,127	2,231	2,364	2,478	2,496	2,395	2,279	2,202	2,061	1,789	1,122	610	35,487
2032	1,623	1,687	1,769	1,852	1,927	1,989	2,044	2,112	2,211	2,334	2,420	2,403	2,255	2,057	1,863	1,528	1,088	709	33,871
2037	1,554	1,614	1,684	1,761	1,838	1,912	1,976	2,029	2,093	2,182	2,279	2,330	2,262	2,036	1,740	1,380	929	726	32,325
2042	1,490	1,546	1,610	1,675	1,749	1,825	1,899	1,962	2,011	2,064	2,132	2,195	2,194	2,042	1,772	1,290	840	652	30,898
2047	1,422	1,482	1,542	1,603	1,664	1,736	1,812	1,885	1,944	1,984	2,017	2,052	2,066	1,981	1,728	1,277	784	583	29,562

* For a fuller definition of the assumptions, see paras 5–18 of the report above.

B MALES IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	2,034	1,648	1,575	1,700	1,771	1,819	1,810	1,898	1,801	1,580	1,317	1,194	1,033	867	648	380	167	62	23,304
1952	1,951	2,010	1,639	1,564	1,683	1,750	1,797	1,785	1,863	1,754	1,511	1,230	1,074	879	674	430	198	81	23,873
1957	1,663	1,930	2,000	1,628	1,548	1,663	1,730	1,775	1,755	1,818	1,682	1,417	1,112	918	688	449	225	100	24,101
1962	1 501	1,647	1,922	1,988	1,613	1,532	1,646	1,711	1,748	1,716	1,748	1,583	1,287	956	724	462	237	113	24,134
1967	1,400	1,488	1,640	1,911	1,970	1,597	1,518	1,630	1,687	1,712	1,654	1,649	1,444	1,113	759	488	245	126	24,031
1972	1,386	1,389	1,482	1,631	1,895	1,952	1,584	1,504	1,609	1,656	1,654	1,566	1,510	1,254	889	516	261	133	23,871
1977	1,389	1,376	1,384	1,474	1,618	1,879	1,937	1,571	1,487	1,581	1,604	1,570	1,439	1,318	1,008	608	277	142	23,662
1982	1,348	1,380	1,372	1,378	1,463	1,605	1,866	1,922	1,554	1,463	1,534	1,526	1,449	1,261	1,066	693	328	153	23,361
1987	1,269	1,340	1,376	1,365	1,367	1,451	1,594	1,852	1,901	1,529	1,420	1,460	1,408	1,270	1,020	733	374	177	22,906
1992	1,187	1,261	1,335	1,369	1,355	1,356	1,441	1,582	1,832	1,872	1,485	1,351	1,347	1,235	1,027	702	396	205	22,338
1997	1,124	1,179	1,258	1,329	1,359	1,344	1,347	1,430	1,565	1,803	1,816	1,413	1,246	1,181	998	707	379	221	21,699
2002	1,079	1,117	1,176	1,251	1,319	1,348	1,335	1,337	1,415	1,540	1,750	1,729	1,303	1,093	955	686	381	218	21,032
2007	1,044	1,072	1,113	1,170	1,242	1,308	1,338	1,325	1,322	1,392	1,494	1,665	1,595	1,143	884	656	371	216	20,350
2012	1,003	1,038	1,069	1,108	1,161	1,232	1,299	1,328	1,311	1,301	1,351	1,422	1,536	1,398	924	608	355	212	19,656
2017	957	997	1,034	1,064	1,099	1,152	1,223	1,289	1,314	1,289	1,263	1,286	1,312	1,347	1,130	636	329	203	18,924
2022	910	951	994	1,030	1,056	1,091	1,144	1,214	1,276	1,293	1,251	1,202	1,186	1,150	1,089	777	344	189	18,147
2027	867	905	948	989	1,022	1,047	1,083	1,135	1,201	1,255	1,255	1,191	1,109	1,040	930	749	420	192	17,338
2032	829	861	902	943	982	1,013	1,040	1,075	1,123	1,182	1,218	1,194	1,099	972	841	640	405	226	16,545
2037	794	824	859	897	936	974	1,006	1,032	1,064	1,105	1,147	1,159	1,102	963	786	578	346	230	15,802
2042	761	789	821	854	891	929	967	999	1,021	1,046	1,073	1,092	1,069	966	779	541	313	205	15,116
2047	726	756	786	817	848	884	922	960	988	1,005	1,016	1,021	1,007	938	781	536	292	183	14,466

C. FEMALES IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	44–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	1,937	1,591	1,530	1,657	1,760	1,827	1,840	1,941	1,865	1,743	1,577	1,430	1,285	1,101	842	539	283	136	24,884
1952	1,880	1,920	1,584	1,521	1,642	1,741	1,808	1,819	1,914	1,831	1,694	1,513	1,343	1,157	928	623	331	175	25,424
1957	1,601	1,865	1,913	1,576	1,508	1,626	1,724	1,789	1,796	1,882	1,785	1,630	1,427	1,216	982	693	388	211	25,612
1962	1,443	1,590	1,859	1,904	1,563	1,495	1,610	1,707	1,769	1,769	1,838	1,723	1,544	1,299	1,040	741	438	252	25,584
1967	1,345	1,434	1,585	1,850	1,889	1,549	1,482	1,596	1,690	1,744	1,731	1,779	1,638	1,413	1,120	792	473	291	25,401
1972	1,330	1,338	1,430	1,578	1,836	1,873	1,537	1,470	1,581	1,669	1,710	1,679	1,697	1,506	1,226	860	512	322	25,154
1977	1,333	1,323	1,335	1,424	1,567	1,822	1,860	1,526	1,458	1,563	1,639	1,663	1,606	1,568	1,316	950	561	355	24,869
1982	1,292	1,327	1,320	1,330	1,415	1,555	1,810	1,848	1,514	1,444	1,538	1,596	1,596	1,490	1,379	1,034	624	395	24,507
1987	1,217	1,287	1,325	1,315	1,322	1,405	1,545	1,797	1,834	1,499	1,419	1,498	1,533	1,480	1,311	1,083	678	436	23,984
1992	1,138	1,212	1,284	1,320	1,306	1,312	1,395	1,535	1,784	1,815	1,474	1,383	1,437	1,422	1,302	1,029	710	478	23,336
1997	1,076	1,133	1,209	1,279	1,311	1,297	1,303	1,386	1,523	1,766	1,786	1,436	1,327	1,334	1,251	1,023	675	507	22,622
2002	1,035	1,071	1,130	1,205	1,271	1,302	1,288	1,295	1,376	1,508	1,736	1,740	1,378	1,232	1,174	982	671	498	21,892
2007	1,000	1,031	1,069	1,126	1,197	1,261	1,293	1,279	1,285	1,361	1,482	1,692	1,670	1,279	1,083	921	645	490	21,164
2012	961	996	1,029	1,065	1,119	1,188	1,253	1,284	1,270	1,272	1,339	1,444	1,624	1,549	1,125	850	605	474	20,447
2017	918	957	994	1,025	1,058	1,111	1,180	1,245	1,275	1,257	1,251	1,304	1,387	1,507	1 362	883	558	448	19,720
2022	873	914	955	990	1,018	1,051	1,103	1,172	1,235	1,262	1,236	1,218	1,252	1,286	1,325	1,069	580	418	18,957
2027	830	869	912	951	983	1,010	1,044	1,096	1,163	1,223	1,241	1,204	1,170	1,162	1,131	1,040	702	418	18,149
2032	794	826	867	909	945	976	1,004	1,037	1,088	1,152	1,202	1,209	1,156	1,085	1,022	888	683	483	17,326
2037	760	790	825	864	902	938	970	997	1,029	1,077	1,132	1,171	1,160	1,073	954	802	583	496	16,523
2042	729	757	789	821	858	896	932	963	990	1,018	1,059	1,103	1,125	1,076	943	749	527	447	15,782
2047	696	726	756	786	816	852	890	925	956	979	1,001	1,031	1,059	1,043	947	741	492	400	15,096

PROJECTION 11

(Assumptions: *Mortality 'Declining'; Marriage-rates 'Intermediate 1942–47', Fertility 'Rising'; Net Migration Nil*)*

A. PERSONS IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	3,971	3,239	3,105	3,357	3,531	3,646	3,650	3,839	3,666	3,323	2,894	2,624	2,318	1,968	1,490	919	450	198	48,188
1952	3,833	3,930	3,223	3,085	3,325	3,491	3,605	3,604	3,777	3,585	3,205	2,743	2,417	2,036	1,602	1,053	529	256	49,299
1957	3,574	3,797	3,913	3,204	3,056	3,289	3,454	3,564	3,551	3,700	3,467	3,047	2,539	2,134	1,670	1,142	613	311	50,025
1962	3,518	3,543	3,783	3,892	3,176	3,027	3,256	3,418	3,517	3,485	3,586	3,306	2,831	2,255	1,764	1,203	675	365	50,600
1967	3,641	3,492	3,531	3,763	3,859	3,146	3,000	3,226	3,377	3,456	3,385	3,428	3,082	2,526	1,879	1,280	718	417	51,206
1972	3,876	3,615	3,482	3,515	3,733	3,825	3,121	2,974	3,190	3,325	3,364	3,245	3,207	2,760	2,115	1,376	773	455	51,951
1977	4 050	3,853	3,605	3,468	3,487	3,703	3,797	3,097	2,945	3,144	3,243	3,233	3,045	2,886	2,324	1,558	838	497	52,773
1982	4,082	4,031	3,842	3,590	3,440	3,460	3,678	3,770	3,068	2,907	3,072	3,122	3,045	2,751	2,445	1,727	952	548	53,530
1987	4,036	4,059	4,017	3,828	3,563	3,416	3,437	3,653	3,735	3,028	2,839	2,958	2,941	2,750	2,331	1,816	1,052	613	54,072
1992	4,017	4,015	4,051	4,001	3,799	3,538	3,394	3,411	3,620	3,687	2,959	2,734	2,784	2,657	2,329	1,731	1,106	683	54,516
1997	4,060	3,996	4,005	4,032	3,972	3,769	3,514	3,368	3,380	3,571	3,602	2,849	2,573	2,515	2,249	1,730	1,054	728	54,967
2002	4,146	4,038	3,986	3,988	4,004	3,942	3,745	3,488	3,337	3,336	3,490	3,469	2,681	2,325	2,129	1,668	1,052	716	55,540
2007	4,218	4,123	4,028	3,970	3,957	3,973	3,917	3,718	3,455	3,295	3,260	3,359	3,265	2,422	1,967	1,577	1,016	706	56,226
2012	4,250	4,194	4,112	4,011	3,940	3,928	3,946	3,888	3,685	3,409	3.218	3,140	3,164	2,947	2,049	1,458	960	686	56,985
2017	4,251	4,226	4,184	4,095	3,983	3,909	3,903	3,918	3,853	3,636	3,330	3,098	2,953	2,856	2,492	1,519	887	651	57,744
2022	4,249	4,231	4,215	4,166	4,066	3,950	3,883	3,874	3,883	3,801	3,553	3,208	2,918	2,668	2,416	1,846	924	607	58,458
2027	4,265	4,228	4,220	4,198	4,137	4,035	3,923	3,855	3,840	3,832	3,714	3,421	3,019	2,632	2,257	1,791	1,122	610	59,099
2032	4,295	4,243	4,217	4,200	4,167	4,105	4,006	3,896	3,821	3,788	3,744	3,577	3,219	2,725	2,229	1,672	1,090	709	59,703
2037	4,320	4,272	4,230	4,197	4,170	4,136	4,076	3,979	3,861	3,770	3,701	3,604	3,366	2,906	2,306	1,652	1,017	726	60,289
2042	4,334	4,296	4,260	4 215	4,167	4,139	4,107	4,048	3,943	3,810	3,682	3,563	3,392	3,038	2,458	1,708	1,002	696	60,858
2047	4,344	4,310	4,286	4,243	4,184	4,136	4,112	4,079	4,012	3,890	3,721	3,546	3,354	3,063	2,570	1,821	1,038	673	61,382

*For a fuller definition of the assumptions, see paras. 5–18 of the report above.

B. MALES IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	2,034	1,648	1,575	1,700	1,771	1,819	1,810	1,898	1,801	1,580	1,317	1,194	1,033	867	648	380	167	62	23,304
1952	1,951	2,010	1,639	1,564	1,683	1,750	1,797	1,785	1,863	1,754	1,511	1,230	1,074	879	674	430	198	81	23,873
1957	1,821	1,930	2,000	1,628	1,548	1,663	1,730	1,775	1,755	1,818	1,682	1,417	1,112	918	688	449	225	100	24,259
1962	1,793	1,803	1,922	1,988	1,613	1,532	1,646	1,711	1,748	1,716	1,748	1,583	1,287	956	724	462	237	113	24,582
1967	1,858	1,778	1,796	1,911	1,970	1,597	1,518	1,630	1,687	1,712	1,654	1,649	1,444	1,113	759	488	245	126	24,935
1972	1,978	1,843	1,772	1,787	1,895	1,952	1,584	1,504	1,609	1,656	1,654	1,566	1,510	1,254	889	516	261	133	25,363
1977	2,067	1,964	1,838	1,764	1,772	1,879	1,937	1,571	1,487	1,581	1,604	1,570	1,439	1,318	1,008	608	277	142	25,826
1982	2,084	2,056	1,958	1,830	1,749	1,757	1,866	1,922	1,554	1,463	1,534	1,526	1,449	1,261	1,066	693	328	153	26,249
1987	2,061	2,070	2,048	1,949	1,815	1,737	1,746	1,852	1,901	1,529	1,420	1,460	1,408	1,270	1,020	733	374	177	26,570
1992	2,051	2,049	2,065	2,039	1,933	1,802	1,725	1,732	1,832	1,872	1,485	1,351	1,347	1,235	1,027	702	396	205	26,848
1997	2,072	2,039	2,042	2,055	2,023	1,918	1,789	1,712	1,713	1,803	1,816	1,413	1,246	1,181	998	707	379	221	27,127
2002	2,117	2,059	2,032	2,033	2,039	2,008	1,905	1,775	1,693	1,686	1,750	1,729	1,303	1,093	955	686	381	218	27,462
2007	2,152	2,104	2,053	2,022	2,016	2,022	1,994	1,891	1,756	1,666	1,636	1,665	1,595	1,143	884	656	371	216	27,842
2012	2,171	2,138	2,097	2,044	2,007	2,000	2,009	1,978	1,871	1,727	1,617	1,558	1,536	1,398	924	608	355	212	28,250
2017	2,171	2,157	2,132	2,088	2,029	1,990	1,987	1,993	1,958	1,841	1,677	1,538	1,436	1,347	1,130	636	329	203	28,642
2022	2,170	2,159	2,150	2,122	2,072	2,011	1,976	1,972	1,972	1,925	1,787	1,596	1,420	1,260	1,089	777	344	189	28,991
2027	2,177	2,157	2,152	2,139	2,106	2,055	1,997	1,961	1,951	1,941	1,869	1,701	1,471	1,244	1,018	749	420	192	29,300
2032	2,193	2,163	2,150	2,141	2,122	2,089	2,040	1,983	1,941	1,920	1,884	1,780	1,567	1,290	1,007	700	405	226	29,601
2037	2,204	2,180	2,155	2,139	2,124	2,106	2,074	2,026	1,962	1,909	1,863	1,793	1,640	1,375	1,044	692	378	230	29,894
2042	2,213	2,191	2,173	2,146	2,123	2,107	2,091	2,059	2,005	1,930	1,853	1,772	1,653	1,438	1,111	717	373	219	30,174
2047	2,218	2,198	2,184	2,163	2,130	2,106	2,094	2,076	2,038	1,971	1,872	1,763	1,635	1,450	1,163	764	388	213	30,426

C. FEMALES IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	1,937	1,591	1,530	1,657	1,760	1,827	1,840	1,941	1,865	1,743	1,577	1,430	1,285	1,101	842	539	283	136	24,884
1952	1,882	1,920	1,584	1,521	1,642	1,741	1,808	1,819	1,914	1,831	1,694	1,513	1,343	1,157	928	623	331	175	25,426
1957	1,753	1,867	1,913	1,576	1,508	1,626	1,724	1,789	1,796	1,882	1,785	1,630	1,427	1,216	982	693	388	211	25,766
1962	1,725	1,740	1,861	1,904	1,563	1,495	1,610	1,707	1,769	1,769	1,838	1,723	1,544	1,299	1,040	741	438	252	26,018
1967	1,783	1,714	1,735	1,852	1,889	1,549	1,482	1,596	1,690	1,744	1,731	1,779	1,638	1,413	1,120	792	473	291	26,271
1972	1,898	1,772	1,710	1,728	1,838	1,873	1,537	1,470	1,581	1,669	1,710	1,679	1,697	1,506	1,226	860	512	322	26,588
1977	1,983	1,889	1,767	1,704	1,715	1,824	1,860	1,526	1,458	1,563	1,639	1,663	1,606	1,568	1,316	950	561	355	26,947
1982	1,998	1,975	1,884	1,760	1,691	1,703	1,812	1,848	1,514	1,444	1,538	1,596	1,596	1,490	1,379	1,034	624	395	27,281
1987	1,975	1,989	1,969	1,879	1,748	1,679	1,691	1,801	1,834	1,499	1,419	1,498	1,533	1,480	1,311	1,083	678	436	27,502
1992	1,966	1,966	1,986	1,962	1,866	1,736	1,669	1,679	1,788	1,815	1,474	1,383	1,437	1,422	1,302	1,029	710	478	27,668
1997	1,988	1,957	1,963	1,977	1,949	1,851	1,725	1,656	1,667	1,768	1,786	1,436	1,327	1,334	1,251	1,023	675	507	27,840
2002	2,029	1,979	1,954	1,955	1,965	1,934	1,840	1,713	1,644	1,650	1,740	1,740	1,378	1,232	1,174	982	671	498	28,078
2007	2,066	2,019	1,975	1,948	1,941	1,951	1,923	1,827	1,699	1,629	1,624	1,694	1,670	1,279	1,083	921	645	490	28,384
2012	2,079	2,056	2,015	1,967	1,933	1,928	1,937	1,910	1,814	1,682	1,601	1,582	1,628	1,549	1,125	850	605	474	28,735
2017	2,080	2,069	2,052	2,007	1,954	1,919	1,916	1,925	1,895	1,795	1,653	1,560	1,517	1,509	1,362	883	558	448	29,102
2022	2,079	2,072	2,065	2,044	1,994	1,939	1,907	1,902	1,911	1,876	1,766	1,612	1,498	1,408	1,327	1,069	580	418	29,467
2027	2,088	2,071	2,068	2,059	2,031	1,980	1,926	1,894	1,889	1,891	1,845	1,720	1,548	1,388	1,239	1,042	702	418	29,799
2032	2,102	2,080	2,067	2,059	2,045	2,016	1,966	1,913	1,880	1,868	1,860	1,797	1,652	1,435	1,222	972	685	483	30,102
2037	2,116	2,092	2,075	2,058	2,046	2,030	2,002	1,953	1,899	1,861	1,838	1,811	1,726	1,531	1,262	960	639	496	30,395
2042	2,121	2,105	2,087	2,069	2,044	2,032	2,016	1,989	1,938	1,880	1,829	1,791	1,739	1,600	1,347	991	629	477	30,684
2047	2,126	2,112	2,102	2,080	2,054	2,030	2,018	2,003	1,974	1,919	1,849	1,783	1,719	1,613	1,407	1,057	650	460	30,956

PROJECTION 12

(Assumptions: *Mortality 'Declining'; Marriage-rates 'Intermediate 1942–47'; Fertility '5 per cent. above 1935–38'; Net Migration '100,000 out'*)*

A. PERSONS IN QUINQUENNIAL AGE-GROUPS 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	3,971	3,239	3,105	3,357	3,531	3,646	3,650	3,839	3,666	3,323	2,894	2,624	2,318	1,968	1,490	919	450	198	48,188
1952	3,785	3,899	3,189	3,044	3,257	3,407	3,535	3,554	3,744	3,562	3,189	2,729	2,406	2,030	1,600	1,053	529	256	48,768
1957	3,311	3,718	3,848	3,130	2,948	3,139	3,301	3,446	3,468	3,644	3,428	3,018	2,516	2,118	1,664	1,141	613	311	48,762
1962	3,066	3,251	3,671	3,786	3,035	2,837	3,038	3,218	3,366	3,381	3,516	3,255	2,793	2,229	1,750	1,198	675	365	48,430
1967	2,979	3,011	3,206	3,611	3,687	2,922	2,741	2,960	3,146	3,285	3,268	3,347	3,025	2,486	1,855	1 270	715	417	47,931
1972	3,040	2,927	2,969	3,150	3,514	3,571	2,829	2,668	2,894	3,074	3,181	3,119	3,120	2,702	2,080	1,358	767	454	47,417
1977	3,089	2,990	2,886	2,915	3,058	3,402	3,475	2,758	2,609	2,829	2,982	3,044	2,916	2,802	2,274	1,532	827	494	46,882
1982	3,019	3,042	2,949	2,833	2,825	2,951	3,310	3,401	2,698	2,552	2,747	2,857	2,856	2,629	2,373	1,690	936	542	46,210
1987	2,870	2,971	3,000	2,896	2,745	2,720	2,861	3,237	3,335	2,641	2,476	2,632	2,681	2,574	2,225	1,762	1,029	604	45,259
1992	2,732	2,824	2,931	2,946	2,808	2,640	2,633	2,790	3,174	3,270	2,565	2,371	2,467	2,416	2,177	1,652	1,073	669	44,138
1997	2,644	2,686	2,783	2,876	2,858	2,701	2,553	2,563	2,731	3,109	3,178	2,456	2,220	2,223	2,044	1,618	1,006	708	42,957
2002	2,600	2,598	2,646	2,731	2,789	2,752	2,614	2,485	2,507	2,673	3,022	3,047	2,300	2,002	1,881	1,517	984	687	41,835
2007	2,558	2,565	2,558	2,593	2,643	2,683	2,663	2,546	2,427	2,452	2,594	2,896	2,857	2,073	1,692	1,395	924	665	40,774
2012	2,491	2,513	2,515	2,507	2,507	2,539	2,595	2,594	2,490	2,372	2,378	2,485	2,716	2,574	1,753	1,256	849	630	39,764
2017	2,403	2,446	2,473	2,462	2,421	2,404	2,452	2,527	2,538	2,433	2,302	2,277	2,329	2,447	2,175	1,301	764	582	38,736
2022	2,311	2,359	2,406	2,421	2,378	2,318	2,317	2,385	2,471	2,482	2,361	2,203	2,134	2,097	2,069	1,613	792	530	37,647
2027	2,233	2,269	2,320	2,354	2,337	2,275	2,232	2,251	2,330	2,416	2,408	2,261	2,064	1,920	1,773	1,535	981	524	36,483
2032	2,168	2,189	2,229	2,268	2,270	2,235	2,190	2,167	2,198	2,276	2,344	2,305	2,117	1,857	1,624	1,316	934	617	35,304
2037	2,105	2,125	2,150	2,178	2,184	2,169	2,149	2,126	2,114	2,146	2,207	2,242	2,159	1,906	1,571	1,205	800	627	34,163
2042	2,037	2,061	2,086	2,101	2,095	2,085	2,084	2,085	2,073	2,063	2,080	2,112	2,100	1,944	1,611	1,165	732	564	33,078
2047	1,967	1,995	2,024	2,036	2,017	1,996	2,001	2,020	2,031	2,022	1,998	1,989	1,977	1,892	1,644	1,196	708	507	32,020

* For a fuller definition of the assumptions, see paras. 5–18 of the report above.

B. MALES IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	2,034	1,648	1,575	1,700	1,771	1,819	1,810	1,898	1,801	1,580	1,317	1,194	1,033	867	648	380	167	62	23,304
1952	1,927	1,994	1,621	1,540	1,642	1,702	1,761	1,760	1,847	1,743	1,504	1,224	1,069	876	673	430	198	81	23,592
1957	1,687	1,890	1,966	1,587	1,484	1,575	1,646	1,715	1,714	1,791	1,664	1,404	1,102	911	685	449	225	100	23,595
1962	1,563	1,654	1,864	1,930	1,531	1,421	1,523	1,604	1,672	1,665	1,715	1,560	1,271	945	718	460	237	113	23,446
1967	1,520	1,533	1,629	1,830	1,872	1,468	1,371	1,483	1,565	1,627	1,598	1,612	1,419	1,096	749	484	244	126	23,226
1972	1,551	1,491	1,510	1,597	1,774	1,807	1,420	1,334	1,448	1,525	1,564	1,507	1,471	1,229	875	509	259	133	23,004
1977	1,576	1,524	1,469	1,479	1,543	1,711	1,757	1,384	1,303	1,412	1,470	1,479	1,380	1,281	987	598	273	141	22,767
1982	1,541	1,551	1,502	1,439	1,426	1,483	1,663	1,719	1,352	1,271	1,362	1,392	1,360	1,207	1,036	679	323	151	22,457
1987	1,465	1,515	1,528	1,471	1,387	1,367	1,437	1,626	1,683	1,320	1,226	1,290	1,280	1,190	975	712	366	174	22,012
1992	1,395	1,440	1,493	1,497	1,419	1,328	1,322	1,401	1,592	1,647	1,275	1,160	1,186	1,120	961	671	385	201	21,493
1997	1,350	1,370	1,418	1,462	1,445	1,359	1,283	1,287	1,369	1,556	1,590	1,207	1,065	1,037	904	662	362	215	20,941
2002	1,327	1,325	1,348	1,388	1,410	1,386	1,314	1,248	1,257	1,337	1,503	1,508	1,108	932	838	622	357	210	20,418
2007	1,305	1,303	1,303	1,317	1,336	1,350	1,339	1,280	1,218	1,226	1,289	1,424	1,386	969	753	576	336	204	19,914
2012	1,272	1,281	1,281	1,274	1,267	1,277	1,305	1,304	1,250	1,187	1,182	1,221	1,309	1,213	783	518	312	194	19,430
2017	1,227	1,248	1,259	1,251	1,223	1,208	1,232	1,270	1,275	1,218	1,146	1,119	1,122	1,145	979	539	280	180	18,921
2022	1,180	1,203	1,226	1,230	1,201	1,165	1,163	1,199	1,241	1,243	1,175	1,084	1,028	981	925	673	292	163	18,372
2027	1,140	1,157	1,182	1,196	1,180	1,143	1,120	1,130	1,169	1,210	1,199	1,113	995	898	792	636	364	163	17,787
2032	1,107	1,116	1,135	1,152	1,146	1,122	1,099	1,088	1,102	1,140	1,167	1,135	1,021	869	726	545	344	195	17,209
2037	1,074	1,084	1,094	1,106	1,102	1,089	1,078	1,067	1,060	1,073	1,099	1,104	1,042	893	703	499	294	197	16,658
2042	1,040	1,051	1,063	1,066	1,057	1,046	1,045	1,046	1,039	1,032	1,034	1,039	1,013	911	721	483	269	175	16,130
2047	1,004	1,017	1,030	1,034	1,017	1,001	1,003	1,013	1,017	1,011	993	978	954	887	736	496	261	158	15,610

C. FEMALES IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	1,937	1,591	1,530	1,657	1,760	1,827	1,840	1,941	1,865	1,743	1,577	1,430	1,285	1,101	842	539	283	136	24,884
1952	1,858	1,905	1,568	1,504	1,615	1,705	1,774	1,794	1,897	1,819	1,685	1,505	1,337	1,154	927	623	331	175	25,176
1957	1,624	1,828	1,882	1,543	1,464	1,564	1,655	1,731	1,754	1,853	1,764	1,614	1,414	1,207	979	692	388	211	25,167
1962	1,503	1,597	1,807	1,856	1,504	1,416	1,515	1,614	1,694	1,716	1,801	1,695	1,522	1,284	1,032	738	438	252	24,984
1967	1,459	1,478	1,577	1,781	1,815	1,454	1,370	1,477	1,581	1,658	1,670	1,735	1,606	1,390	1,106	786	471	291	24,705
1972	1,489	1,436	1,459	1,553	1,740	1,764	1,409	1,334	1,446	1,549	1,617	1,612	1,649	1,473	1,205	849	508	321	24,413
1977	1,513	1,466	1,417	1,436	1,515	1,691	1,718	1,374	1,306	1,417	1,512	1,565	1,536	1,521	1,287	934	554	353	24,115
1982	1,478	1,491	1,447	1,394	1,399	1,468	1,647	1,682	1,346	1,281	1,385	1,465	1,496	1,422	1,337	1,011	613	391	23,753
1987	1,405	1,456	1,472	1,425	1,358	1,353	1,424	1,611	1,652	1,321	1,250	1,342	1,401	1,384	1,250	1,050	663	430	23,247
1992	1,337	1,384	1,438	1,449	1,389	1,312	1,311	1,389	1,582	1,623	1,290	1,211	1,281	1,296	1,216	981	688	468	22,645
1997	1,294	1,316	1,365	1,414	1,413	1,342	1,270	1,276	1,362	1,553	1,588	1,249	1,155	1,186	1,140	956	644	493	22,016
2002	1,273	1,273	1,298	1,343	1,379	1,366	1,300	1,237	1,250	1,336	1,519	1,539	1,192	1,070	1,043	895	627	477	21,417
2007	1,253	1,252	1,255	1,276	1,307	1,333	1,324	1,266	1,209	1,226	1,305	1,472	1,471	1,104	939	819	588	461	20,860
2012	1,219	1,232	1,234	1,233	1,240	1,262	1,290	1,290	1,240	1,185	1,196	1,264	1,407	1,361	970	738	537	436	20,334
2017	1,176	1,198	1,214	1,211	1,198	1,196	1,220	1,257	1,263	1,215	1,156	1,158	1,207	1,302	1,196	762	484	402	19,815
2022	1,131	1,156	1,180	1,191	1,177	1,153	1,154	1,186	1,230	1,239	1,186	1,119	1,106	1,116	1,144	940	500	367	19,275
2027	1,093	1,112	1,138	1,158	1,157	1,132	1,112	1,121	1,161	1,206	1,209	1,148	1,069	1,022	981	899	617	361	18,696
2032	1,061	1,073	1,094	1,116	1,124	1,113	1,091	1,079	1,096	1,136	1,177	1,170	1,096	988	898	771	590	422	18,095
2037	1,031	1,041	1,056	1,072	1,082	1,080	1,071	1,059	1,054	1,073	1,108	1,138	1,117	1,013	868	706	506	430	17,505
2042	997	1,010	1,023	1,035	1,038	1,039	1,039	1,039	1,034	1,031	1,046	1,073	1,087	1,033	890	682	463	389	16,948
2047	963	978	994	1,002	1,000	995	998	1,007	1,014	1,011	1,005	1,011	1,023	1,005	908	700	447	349	16,410

PROJECTION 13

(Assumptions: *Mortality 'Declining', Marriage-rates 'Intermediate 1942–47', Fertility '5 per cent. above 1935–38', Net Migration '100,000 in'*)*

A. PERSONS IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	3,971	3,239	3,105	3,357	3,531	3,646	3,650	3,839	3,666	3,323	2,894	2,624	2,318	1,968	1,490	919	450	198	48,188
1952	3,879	3,961	3,257	3,126	3,393	3,575	3,675	3,654	3,810	3,608	3,221	2,757	2,428	2,042	1,604	1,053	529	256	49,828
1957	3,527	3,874	3,978	3,278	3,164	3,439	3,607	3,682	3,634	3,756	3,506	3,076	2,562	2,150	1,676	1,143	613	311	50,976
1962	3,396	3,529	3 893	3,998	3,317	3,217	3,474	3,618	3,668	3,589	3,656	3,357	2,869	2,281	1,778	1,208	675	365	51,888
1967	3,407	3,403	3,550	3,913	4,031	3,370	3,259	3,492	3,608	3,627	3,502	3,509	3,139	2,566	1 903	1,290	721	417	52,707
1972	3,552	3,415	3,425	3,574	3,950	4,079	3,413	3,280	3,486	3,576	3,547	3,371	3,294	2,818	2,150	1,394	779	456	53,559
1977	3,683	3,562	3,438	3,451	3,614	4,002	4,119	3,436	3,281	3,459	3,504	3,422	3,174	2,970	2,374	1,584	849	500	54,422
1982	3,703	3,696	3,585	3,465	3,493	3,669	4,044	4,139	3,438	3,262	3,397	3,387	3,234	2,873	2 517	1,764	968	554	55,188
1987	3,652	3,715	3,718	3,612	3,507	3,552	3,715	4,065	4,135	3,415	3,202	3,284	3,201	2,926	2,437	1,870	1,075	622	55,703
1992	3,610	3,664	3 739	3,744	3,652	3,566	3,597	3,738	4,062	4,104	3,353	3,097	3,101	2,898	2,481	1,810	1,139	697	56,052
1997	3,616	3,622	3,689	3,764	3,784	3,709	3,611	3 621	3,737	4,031	4,026	3,242	2 926	2 807	2,454	1,842	1,102	748	56,331
2002	3,660	3,628	3,646	3,713	3,805	3,840	3,754	3,635	3,621	3,711	3,954	3,891	3,062	2,648	2,377	1,819	1,120	745	56,629
2007	3.704	3,671	3,652	3,673	3,753	3,859	3,885	3,776	3,635	3,596	3,642	3,820	3,673	2 771	2,242	1,759	1,108	747	56,966
2012	3,723	3,715	3,695	3,677	3,713	3,809	3,903	3,906	3,776	3,610	3,530	3,521	3,608	2,320	2,345	1,660	1,071	742	57,324
2017	3,723	3,734	3,739	3,722	3,719	3,768	3,854	3,925	3 904	3 749	3,542	3,411	3,323	3,263	2,809	1,737	1,010	720	57,652
2022	3,721	3,737	3,758	3,765	3,762	3,774	3,813	3,875	3,923	3,874	3,679	3,425	3,222	3,007	2,761	2,079	1,056	684	57,915
2027	3,729	3,733	3,760	3,784	3,805	3,817	3,818	3,835	3,874	3,894	3,802	3,555	3,234	2,914	2,545	2,045	1,263	696	58,103
2032	3,750	3,741	3,757	3,784	3,824	3,859	3,860	3,841	3,834	3,846	3,820	3,675	3,357	2,925	2,468	1,884	1,244	801	58,270
2037	3,769	3,761	3,764	3,780	3,824	3,879	3,903	3,882	3,840	3,806	3,773	3,692	3,469	3,036	2,475	1,827	1,146	825	58,451
2042	3,787	3,781	3,784	3,789	3,821	3,879	3,922	3,925	3,881	3,811	3,734	3,646	3,486	3,136	2,569	1,833	1,110	784	58,678
2047	3,799	3,797	3,804	3,810	3,831	3,876	3,923	3,944	3,925	3,852	3,740	3,609	3,443	3,152	2,654	1,902	1,114	749	58,924

* For a fuller definition of the assumptions, see paras. 5–18 of the report above

B. MALES IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (nud-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	3,034	1,648	1,575	1,700	1,771	1,819	1,810	1,898	1,801	1,580	1,317	1,194	1,033	867	648	380	167	62	23,304
1952	1,975	2,026	1,657	1,588	1,724	1,798	1,833	1,810	1,879	1,765	1,518	1,236	1,079	882	675	430	198	81	24 154
1957	1,797	1,970	2,034	1,669	1,612	1,751	1,814	1,835	1,796	1,845	1,700	1,430	1,122	925	691	449	225	100	24 765
1962	1,731	1,796	1,980	2,046	1,695	1,643	1,769	1,818	1,824	1,767	1,781	1,606	1,303	967	730	464	237	113	25,270
1967	1,738	1,733	1,807	1,992	2,068	1,726	1,665	1,777	1,809	1,797	1,710	1,686	1,469	1,130	769	492	246	126	25,740
1972	1,813	1,741	1,744	1,821	2,016	2,097	1,748	1,674	1,770	1,787	1,744	1,625	1,549	1,279	903	523	263	133	26,230
1977	1,880	1,816	1,753	1,759	1,847	2,047	2,117	1,758	1,671	1,750	1,738	1,661	1,498	1,355	1,029	618	281	143	26,721
1982	1,891	1,885	1,828	1,769	1,786	1,879	2,069	2,125	1,756	1,655	1,706	1,660	1,538	1,315	1,096	707	333	155	27,153
1987	1,865	1,895	1,896	1,843	1,795	1,821	1,903	2,078	2,119	1,738	1,614	1,630	1,536	1,350	1,065	754	382	180	27,464
1992	1,843	1,870	1,907	1,911	1,869	1,830	1,844	1,913	2,072	2,097	1,695	1,542	1,508	1,350	1,093	735	407	209	27,693
1997	1,846	1,848	1,882	1,922	1,937	1,903	1,853	1,855	1,909	2,050	2,042	1,619	1,427	1,325	1,092	752	396	227	27,885
2002	1,869	1,851	1,860	1,896	1,948	1,970	1,926	1,864	1,851	1,889	1,997	1,950	1,498	1,254	1,072	750	405	226	28,076
2007	1,891	1,873	1,863	1,875	1,922	1,980	1,993	1 936	1,860	1,832	1,841	1,906	1,804	1,317	1,015	736	406	228	28,278
2012	1,902	1,895	1,885	1,878	1,901	1,955	2,003	2,002	1,932	1,841	1,786	1,759	1,763	1,583	1,065	698	398	230	28,476
2017	1,901	1,906	1,907	1,901	1,905	1,934	1,978	2,012	1,997	1,912	1,794	1,705	1,626	1,549	1,281	733	378	226	28,645
2022	1,900	1,907	1,918	1,922	1,927	1,937	1,957	1,987	2,007	1,975	1,863	1,714	1,578	1,429	1,253	881	396	215	28,766
2027	1,904	1,905	1,918	1,932	1,948	1,959	1,960	1,966	1,983	1,986	1,925	1,779	1,585	1,386	1 156	862	476	221	28,851
2032	1,915	1,908	1,917	1,932	1,958	1,980	1,981	1,970	1,962	1,962	1,935	1,839	1,645	1,393	1,122	795	466	257	28,937
2037	1,924	1,920	1,920	1,930	1,958	1,991	2,002	1,991	1,966	1,941	1,911	1,848	1,700	1,445	1,127	771	430	263	29,038
2042	1,934	1,929	1,931	1,934	1,957	1,990	2,013	2,012	1,987	1,944	1,892	1,825	1,709	1,493	1,169	775	417	249	29,160
2047	1,940	1,937	1,940	1,946	1,961	1,989	2,013	2,023	2,009	1,965	1,895	1,806	1,688	1,501	1,208	804	419	238	29,282

C. FEMALES IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	1,937	1,591	1,530	1,657	1,760	1,827	1,840	1,941	1,865	1,743	1,577	1,430	1,285	1,101	842	539	283	136	24,884
1952	1,904	1,935	1,600	1,538	1,669	1,777	1,842	1,844	1,931	1,843	1,703	1,521	1,349	1,160	929	623	331	175	25,674
1957	1,730	1,904	1,944	1,609	1,552	1,688	1,793	1,847	1,838	1,911	1,806	1,646	1,440	1,225	985	694	388	211	26,211
1962	1,665	1,733	1,913	1,952	1,622	1,574	1,705	1,800	1,844	1,822	1,875	1,751	1,566	1,314	1,048	744	438	252	26,618
1967	1,669	1,670	1,743	1,921	1,963	1,644	1,594	1,715	1,799	1,830	1,792	1,823	1,670	1,436	1,134	798	475	291	26,967
1972	1,739	1,674	1,681	1,753	1,934	1,982	1,665	1,606	1,716	1,789	1,803	1,746	1,745	1,539	1,247	871	516	323	27,329
1977	1,803	1,746	1,685	1,692	1,767	1,955	2,002	1,678	1,610	1,709	1,766	1,761	1,676	1,615	1,345	966	568	357	27,701
1982	1,812	1,811	1,757	1,696	1,707	1,790	1,975	2,014	1,682	1,607	1,691	1,727	1 696	1,558	1,421	1,057	635	399	28,035
1987	1,787	1,820	1,822	1,769	1,712	1,731	1,812	1,987	2,016	1,677	1,588	1,654	1,665	1,576	1,372	1,116	693	442	28,239
1992	1,767	1,794	1,832	1,833	1,783	1,736	1,753	1,825	1,990	2,007	1,658	1,555	1,593	1,548	1,388	1,077	732	488	28,359
1997	1,770	1,774	1,807	1,842	1,847	1,806	1,758	1,766	1,828	1,981	1,984	1,623	1,499	1,482	1,362	1,090	706	521	28,446
2002	1,791	1,777	1,786	1,817	1,857	1,870	1,828	1,771	1,770	1,822	1,957	1,941	1,564	1,394	1,305	1,069	715	519	28,553
2007	1,813	1,798	1,789	1,798	1,831	1,879	1,892	1,840	1,775	1,764	1,801	1,914	1,869	1,454	1,227	1,023	702	519	28,688
2012	1,821	1,820	1,810	1,799	1,812	1,854	1,900	1,904	1,844	1,769	1,744	1,762	1,845	1,737	1,280	962	673	512	28,848
2017	1,822	1,828	1,832	1,821	1,814	1,834	1,876	1,913	1,907	1,837	1,748	1,706	1,697	1,714	1,528	1,004	632	494	29,007
2022	1,821	1,830	1,840	1,843	1,835	1,837	1,856	1,888	1,916	1,899	1,816	1,711	1,644	1,578	1,508	1,198	660	469	29,149
2027	1,825	1,828	1,842	1,852	1,857	1,858	1,858	1,869	1,891	1,908	1,877	1,776	1,649	1,528	1,389	1,183	787	475	29,252
2032	1,835	1,833	1,840	1 852	1,866	1,879	1,879	1,871	1,872	1,884	1,885	1,836	1,712	1,532	1,346	1,089	778	544	29,333
2037	1,845	1,841	1,844	1,850	1,866	1,888	1,901	1,891	1,874	1,865	1,862	1,844	1,769	1,591	1,348	1,056	716	562	29,413
2042	1,853	1,852	1,853	1,855	1,864	1,889	1,909	1,913	1,894	1,867	1,842	1,821	1,777	1,643	1,400	1,058	693	535	29,518
2047	1,859	1,860	1,864	1,864	1,870	1,887	1,910	1,921	1,916	1 887	1,845	1,803	1,755	1,651	1,446	1,098	695	511	29,642

B. MALES IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	2,034	1,648	1,575	1,700	1,771	1,819	1,810	1,898	1,801	1,580	1,317	1,194	1,033	867	648	380	167	62	23,304
1952	1,939	2,002	1,630	1,552	1,663	1,726	1,779	1,773	1,855	1,749	1,507	1,227	1,072	878	674	430	198	81	23,735
1957	1,714	1,910	1,983	1,607	1,516	1,619	1,688	1,745	1,735	1,805	1,673	1,411	1,107	915	687	449	225	100	23,389
1962	1,605	1,689	1,893	1,959	1,572	1,476	1,584	1,657	1,710	1,691	1,731	1,572	1,279	950	721	461	237	113	23,900
1967	1,574	1,583	1,674	1,871	1,921	1,533	1,445	1,557	1,626	1,669	1,626	1,630	1,431	1,105	754	486	245	126	23,856
1972	1,617	1,554	1,568	1,653	1,835	1,880	1,502	1,419	1,528	1,591	1,609	1,536	1,491	1,242	882	513	260	133	23,813
1977	1,652	1,597	1,540	1,549	1,619	1,795	1,847	1,477	1,395	1,496	1,537	1,524	1,409	1,300	998	603	275	142	23,755
1982	1,629	1,634	1,583	1,522	1,516	1,582	1,765	1,820	1,453	1,367	1,448	1,459	1,405	1,234	1,051	686	325	152	23,631
1987	1,565	1,610	1,620	1,564	1,489	1,481	1,553	1,739	1,792	1,424	1,323	1,375	1,344	1,230	998	723	370	176	23,376
1992	1,507	1,548	1,596	1,600	1,531	1,454	1,452	1,529	1,712	1,760	1,380	1,256	1,266	1,177	994	687	390	203	23,042
1997	1,474	1,489	1,534	1,577	1,568	1,495	1,425	1,429	1,504	1,680	1,703	1,310	1,156	1,109	951	684	371	218	22,677
2002	1,463	1,456	1,476	1,515	1,545	1,532	1,467	1,402	1,405	1,475	1,626	1,619	1,205	1,013	897	654	369	214	22,333
2007	1,452	1,445	1,443	1,457	1,483	1,508	1,503	1,444	1,379	1,377	1,427	1,544	1,491	1,056	819	616	354	210	22,008
2012	1,430	1,434	1,432	1,425	1,425	1,447	1,480	1,479	1,420	1,351	1,333	1,356	1,422	1,305	853	563	333	203	21,691
2017	1,395	1,412	1,421	1,414	1,394	1,390	1,419	1,456	1,455	1,392	1,308	1,265	1,248	1,246	1,055	587	305	192	21,354
2022	1,360	1,379	1,399	1,403	1,383	1,358	1,362	1,396	1,432	1,426	1,347	1,242	1,165	1,093	1,007	725	318	176	20,971
2027	1,331	1,344	1,366	1,380	1,372	1,347	1,330	1,339	1,373	1,404	1,380	1,279	1,142	1,020	883	693	392	177	20,552
2032	1,309	1,314	1,331	1,347	1,349	1,337	1,319	1,308	1,317	1,346	1,359	1,311	1,177	1,000	825	608	375	210	20,142
2037	1,286	1,293	1,301	1,312	1,316	1,315	1,309	1,298	1,287	1,290	1,302	1,290	1,206	1,031	809	567	328	212	19,752
2042	1,264	1,271	1,280	1,283	1,282	1,282	1,287	1,287	1,276	1,260	1,249	1,236	1,187	1,056	833	556	306	193	19,388
2047	1,238	1,247	1,257	1,262	1,253	1,248	1,255	1,266	1,265	1,249	1,219	1,185	1,138	1,040	854	573	301	178	19,028

C. FEMALES IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	1,937	1,591	1,530	1,657	1,760	1,827	1,840	1,941	1,865	1,743	1,577	1,430	1,285	1,101	842	539	283	136	24,884
1952	1,870	1,912	1,576	1,512	1,629	1,723	1,791	1,806	1,905	1,825	1,689	1,509	1,340	1,155	928	623	331	175	25,299
1957	1,650	1,847	1,898	1,560	1,486	1,595	1,690	1,760	1,775	1,868	1,775	1,622	1,420	1,212	980	693	388	211	25,430
1962	1,544	1,631	1,833	1,880	1,533	1,455	1,562	1,660	1,732	1,742	1,819	1,709	1,533	1,291	1,036	740	438	252	25,390
1967	1,512	1,526	1,618	1,816	1,852	1,502	1,426	1,536	1,635	1,701	1,700	1,757	1,622	1,401	1,113	789	472	291	25,269
1972	1,551	1,495	1,515	1,603	1,789	1,818	1,473	1,402	1,513	1,609	1,663	1 645	1,673	1,490	1,216	855	510	322	25,142
1977	1,585	1,536	1,484	1,500	1,578	1,757	1,789	1,450	1,382	1,490	1,576	1,614	1,571	1,544	1,301	942	558	354	25,011
1982	1,561	1,571	1,525	1,469	1,476	1,548	1,729	1,765	1,430	1,363	1,462	1,530	1,546	1,456	1,358	1,022	619	393	24,823
1987	1,500	1,547	1,559	1,511	1,446	1,448	1,521	1,705	1,743	1,410	1,334	1,420	1,467	1,432	1,280	1,066	670	432	24,491
1992	1,445	1,486	1,537	1,545	1,487	1,418	1,421	1,498	1,684	1,719	1,382	1,297	1,359	1,359	1,259	1,005	699	473	24,073
1997	1,413	1,430	1,476	1,521	1,521	1,458	1,392	1,399	1,478	1,660	1,687	1,343	1,241	1,260	1,195	990	659	501	23,624
2002	1,402	1,399	1,420	1,461	1,498	1,492	1,432	1,370	1,380	1,458	1,628	1,640	1,285	1,151	1,108	938	649	488	23,199
2007	1,393	1,388	1,389	1,407	1,438	1,469	1,466	1,409	1,351	1,360	1,429	1,582	1,571	1,191	1,011	870	616	476	22,816
2012	1,369	1,379	1,378	1,374	1,383	1,410	1,442	1,444	1,391	1,331	1,333	1,389	1,517	1,455	1,047	794	571	455	22,462
2017	1,338	1,355	1,368	1,364	1,352	1,355	1,384	1,421	1,424	1,370	1,304	1,295	1,329	1,405	1,279	822	521	425	22,111
2022	1,304	1,325	1,345	1,354	1,341	1,324	1,330	1,362	1,402	1,404	1,344	1,267	1,240	1,232	1,235	1,004	540	393	21,746
2027	1,276	1,291	1,314	1,332	1,332	1,314	1,298	1,308	1,343	1,381	1,376	1,305	1,214	1,148	1,083	970	659	390	21,334
2032	1,255	1,263	1,280	1,300	1,310	1,304	1,288	1,277	1,290	1,323	1,354	1,337	1,250	1,124	1,010	850	637	453	20,905
2037	1,234	1,241	1,253	1,266	1,278	1,282	1,279	1,267	1,259	1,271	1,297	1,315	1,280	1,157	988	794	558	463	20,482
2042	1,211	1,221	1,230	1,240	1,244	1,251	1,256	1,258	1,249	1,240	1,245	1,260	1,260	1,185	1,018	776	520	425	20,089
2047	1,187	1,198	1,211	1,217	1,218	1,218	1,226	1,235	1,240	1,230	1,215	1,209	1,206	1,166	1,042	799	509	389	19,715

PROJECTION 15

(Assumptions: *Mortality* ' *Declining* '; *Marriage-rates* ' *Intermediate 1942–47*'; *Fertility* ' *5 per cent. above 1935–38* '; *Net Migration* ' *50,000 in* ')*

A. PERSONS IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	3,971	3,239	3,105	3,357	3,531	3,646	3,650	3,839	3,666	3,323	2,894	2,624	2,318	1,968	1,490	919	450	198	48,188
1952	3,855	3,946	3,240	3,106	3,358	3,533	3,640	3,629	3,794	3,596	3,214	2,750	2,422	2,039	1,602	1,053	529	256	49,562
1957	3,474	3,835	3,945	3,241	3,110	3,364	3,530	3,623	3,592	3,727	3,486	3,061	2,551	2,141	1,673	1,142	613	311	50,419
1962	3,313	3,460	3,838	3,945	3,247	3,123	3,366	3,519	3,592	3,537	3,622	3,331	2,850	2,269	1,771	1,205	675	365	51,028
1967	3,300	3,305	3,464	3,837	3,945	3,257	3,129	3,359	3,493	3,542	3,444	3,469	3,111	2,546	1,891	1,285	719	417	51,513
1972	3,424	3,293	3,311	3,468	3,840	3,952	3,267	3,127	3,339	3,450	3,456	3,309	3,250	2,788	2,132	1,384	776	455	52,021
1977	3,535	3,419	3,300	3,317	3,475	3,852	3,958	3,267	3,113	3,302	3,373	3,328	3,110	2,928	2,349	1,571	843	498	52,538
1982	3,532	3,533	3,426	3,307	3,326	3,490	3,860	3,955	3,253	3,084	3,234	3,255	3,139	2,812	2,481	1,746	960	551	52,944
1987	3,457	3,529	3,539	3,433	3,317	3,343	3,502	3,858	3,935	3,222	3,021	3,121	3,071	2,838	2,384	1,843	1,064	618	53,095
1992	3,390	3,454	3,537	3,545	3,442	3,334	3,357	3,501	3,840	3,895	3,156	2,915	2,943	2,778	2,405	1,770	1,123	690	53,075
1997	3,373	3,389	3,462	3,542	3,553	3,457	3,347	3,356	3,486	3,800	3,814	3,045	2,749	2,661	2,352	1,786	1,078	737	52,987
2002	3,395	3,371	3,396	3,468	3,551	3,568	3,469	3,348	3,343	3,451	3,722	3,679	2,872	2,486	2,253	1,744	1,086	730	52,932
2007	3,417	3,393	3,378	3,402	3,475	3,565	3,579	3,469	3,332	3,311	3,380	3,590	3,468	2,597	2,104	1,668	1,062	726	52,916
2012	3,415	3,415	3,400	3,385	3,412	3,491	3,576	3,577	3,455	3,300	3,242	3,261	3,385	3,134	2,198	1,559	1,016	714	52,935
2017	3,393	3,413	3,423	3,406	3,394	3,427	3,503	3,575	3,563	3,420	3,232	3,128	3,075	3,059	2,650	1,629	948	685	52,923
2022	3,368	3,392	3,420	3,429	3,416	3,410	3,438	3,502	3,560	3,526	3,349	3,119	2,951	2,779	2,588	1,963	990	645	52,845
2027	3,355	3,367	3,400	3,426	3,438	3,431	3,422	3,439	3,488	3,525	3.454	3.232	2,942	2,666	2,352	1,917	1,193	653	52,700
2032	3,354	3,353	3,375	3,405	3,435	3,453	3,443	3,423	3,425	3,453	3,451	3,332	3,047	2,658	2,257	1,742	1,166	755	52,527
2037	3,354	3,352	3,360	3,380	3,414	3,451	3,464	3,443	3,408	3,391	3,381	3,329	3,142	2,754	2,249	1,671	1,060	777	52,380
2042	3,349	3,350	3,360	3,367	3,390	3,431	3,463	3,465	3,429	3,374	3,320	3,262	3,139	2,839	2,329	1,666	1,016	730	52,279
2047	3,341	3,347	3,360	3,367	3,377	3,406	3,443	3,463	3,451	3,395	3,304	3,204	3,076	2,838	2,402	1,726	1,012	689	52,201

* For a fuller definition of the assumptions, see paras. 5–18 of the report above.

B. MALES IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	2,034	1,648	1,575	1,700	1,771	1,819	1,810	1,898	1,801	1,580	1,317	1,194	1,033	867	648	380	167	62	23,304
1952	1,963	2,018	1,648	1,576	1,703	1,774	1,815	1,797	1,871	1,759	1,515	1,233	1,076	880	674	430	198	81	24,011
1957	1,770	1,950	2,017	1,649	1,580	1,707	1,772	1,805	1,775	1,831	1,691	1,423	1,117	921	689	449	225	100	24,471
1962	1,689	1,761	1,951	2,017	1,654	1,588	1,708	1,765	1,786	1,741	1,765	1,594	1,295	962	727	463	237	113	24,816
1967	1,684	1,683	1,762	1,951	2,019	1,661	1,591	1,703	1,748	1,755	1,682	1,668	1,457	1,121	764	490	245	126	25,110
1972	1,747	1,678	1,686	1,765	1,955	2,024	1,666	1,589	1,690	1,721	1,699	1,596	1,529	1,266	896	519	262	133	25,421
1977	1,804	1,743	1,682	1,689	1,771	1,963	2,027	1,665	1,579	1,666	1,671	1,616	1,469	1,336	1,018	613	279	142	25,733
1982	1,803	1,802	1,747	1,686	1,696	1,780	1,967	2,024	1,655	1,559	1,620	1,593	1,493	1,288	1,081	700	331	154	25,979
1987	1,765	1,800	1,804	1,750	1,693	1,707	1,787	1,965	2,010	1,634	1,517	1,545	1,472	1,310	1,042	743	378	178	26,100
1992	1,731	1,762	1,804	1,808	1,757	1,704	1,714	1,785	1,952	1,984	1,590	1,446	1,428	1,293	1,060	717	402	207	26,144
1997	1,722	1,729	1,766	1,807	1,814	1,767	1,711	1,713	1,774	1,926	1,929	1,516	1,336	1,253	1,045	730	387	242	26,149
2002	1,733	1,720	1,732	1,769	1,813	1,824	1,773	1,710	1,703	1,751	1,874	1,839	1,401	1,173	1,013	718	393	222	26,161
2007	1,744	1,731	1,723	1,735	1,775	1,822	1,829	1,772	1,699	1,681	1,703	1,786	1,699	1,230	949	696	388	222	26,184
2012	1,744	1,742	1,734	1,727	1,743	1,785	1,828	1,827	1,762	1,677	1,635	1,624	1,650	1,491	995	653	377	221	26,215
2017	1,733	1,742	1,745	1,738	1,734	1,752	1,791	1,826	1,817	1,738	1,632	1,559	1,500	1,448	1,205	685	353	214	26,212
2022	1,720	1,731	1,745	1,749	1,745	1,744	1,758	1,790	1,816	1,792	1,691	1,556	1,441	1,317	1,171	829	370	202	26,167
2027	1,713	1,718	1,734	1,748	1,756	1,755	1,750	1,757	1,779	1,792	1,744	1,613	1,438	1,264	1,065	805	448	207	26,086
2032	1,713	1,710	1,721	1,737	1,755	1,765	1,761	1,750	1,747	1,756	1,743	1,663	1,489	1,262	1,023	732	435	242	26,004
2037	1,712	1,711	1,713	1,724	1,744	1,765	1,771	1,760	1,739	1,724	1,708	1,662	1,536	1,307	1,021	703	396	248	25,944
2042	1,710	1,709	1,714	1,717	1,732	1,754	1,771	1,771	1,750	1,716	1,677	1,628	1,535	1,348	1,057	702	380	231	25,902
2047	1,706	1,707	1,713	1,718	1,725	1,742	1,761	1,770	1,761	1,727	1,669	1,599	1,504	1,348	1,090	727	379	218	25,864

C. FEMALES IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55 59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	1,937	1,591	1,530	1,657	1,760	1,827	1,840	1,941	1,865	1,743	1,577	1,430	1,285	1,101	842	539	283	136	24,884
1952	1,892	1,928	1,592	1,530	1,655	1,759	1,825	1,832	1,923	1,837	1,699	1,517	1,346	1,159	928	623	331	175	25,551
1957	1,704	1,885	1,928	1,592	1,530	1,657	1,758	1,818	1,817	1,896	1,795	1,638	1,434	1,220	984	693	388	211	25,948
1962	1,624	1,699	1,887	1,928	1,593	1,535	1,658	1,754	1,806	1,796	1,857	1,737	1,555	1,307	1,044	742	438	252	26,212
1967	1,616	1,622	1,702	1,886	1,926	1,596	1,538	1,656	1,745	1,787	1,762	1,801	1,654	1,425	1,127	795	474	291	26,403
1972	1,677	1,615	1,625	1,703	1,885	1,928	1,601	1,538	1,649	1,729	1,757	1,713	1,721	1,522	1,236	865	514	322	26,600
1977	1,731	1,676	1,618	1,628	1,704	1,889	1,931	1,602	1,534	1,636	1,702	1,712	1,641	1,592	1 331	958	564	356	26,805
1982	1,729	1,731	1,679	1,621	1,630	1,710	1,893	1,931	1,598	1,525	1,614	1,662	1,646	1,524	1,400	1,046	629	397	26,965
1987	1,692	1,729	1,735	1,683	1,624	1,636	1,715	1,893	1,925	1,588	1,504	1,576	1,599	1,528	1,342	1,100	686	440	26,995
1992	1,659	1,692	1,733	1,737	1,685	1,630	1,643	1,716	1,888	1,911	1,566	1,469	1,515	1,485	1,345	1,053	721	483	26,931
1997	1,651	1,660	1,696	1,735	1,739	1,690	1,636	1,643	1,712	1,874	1,885	1,529	1,413	1,408	1,307	1,056	691	513	26,838
2002	1,662	1,651	1,664	1,699	1,738	1,744	1,696	1,638	1,640	1,700	1,848	1,840	1,471	1,313	1,230	1,026	693	508	26,771
2007	1,673	1,662	1,655	1,667	1,700	1,743	1,750	1,697	1,633	1,630	1,677	1,804	1,769	1,367	1,155	972	674	504	26,732
2012	1,671	1,673	1,666	1,658	1,669	1,706	1,748	1,750	1,693	1,623	1,607	1,637	1,735	1,643	1,203	906	639	493	26,720
2017	1,660	1,671	1,678	1,668	1,660	1,675	1,712	1,749	1,746	1,682	1,600	1,569	1,575	1,611	1,435	944	595	471	26,701
2022	1,648	1,661	1,675	1,680	1,671	1,666	1,680	1,712	1,744	1,734	1,658	1,563	1,510	1,462	1,417	1,134	620	443	26,678
2027	1,642	1,649	1,666	1,678	1,682	1,676	1,672	1,682	1,709	1,733	1,710	1,619	1,504	1,402	1,287	1,112	745	446	26,614
2032	1,641	1,643	1,654	1,668	1,680	1,688	1,682	1,673	1,678	1,697	1,708	1,669	1,558	1,396	1,234	1,010	731	513	26,523
2037	1,642	1,641	1,647	1,656	1,670	1,686	1,693	1,683	1,669	1,667	1,673	1,667	1,606	1,447	1,228	968	664	529	26,436
2042	1,639	1,641	1,646	1,650	1,658	1,677	1,692	1,694	1,679	1,658	1,643	1,634	1,604	1,491	1,272	964	636	499	26,377
2047	1,635	1,640	1,647	1,649	1,652	1,664	1,682	1,693	1,690	1,668	1,635	1,605	1,572	1,490	1,312	999	633	471	26,337

PROJECTION 16

(Assumptions· *Mortality 'Declining', Marriage-rates 'Intermediate 1942–47', Fertility 'Falling', Net Migration '100,000 in'*)*

A. PERSONS IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	3,971	3,239	3,105	3,357	3,531	3,646	3,650	3,839	3,666	3,323	2,894	2,624	2,318	1,968	1,490	919	450	198	48,188
1952	3,878	3,961	3,257	3,126	3,393	3,575	3,675	3,654	3,810	3,608	3,221	2,757	2,428	2,042	1,604	1,053	529	256	49,827
1957	3,372	3,873	3,978	3,278	3,164	3,439	3,607	3,682	3,634	3,756	3,506	3,076	2,562	2,150	1,676	1,143	613	311	50,820
1962	3,109	3,376	3,892	3,998	3,317	3,217	3,474	3,618	3,668	3,589	3,656	3,357	2,869	2,281	1,778	1,208	675	365	51,447
1967	2,959	3,118	3,397	3,912	4,031	3,370	3,259	3,492	3,608	3,627	3,502	3,509	3,139	2,566	1,903	1,290	721	417	51,820
1972	2,972	2,971	3,140	3,421	3,949	4,079	3,413	3,280	3,486	3,576	3,547	3,371	3,294	2,818	2,150	1,394	779	456	52,096
1977	3,019	2,985	2,995	3,166	3,463	4,001	4,119	3,436	3,281	3,459	3,504	3,422	3,174	2,970	2,374	1,584	849	500	52,301
1982	2,982	3,034	3,010	3,024	3,212	3,519	4,043	4,139	3,438	3,262	3,397	3,387	3,234	2,873	2,517	1,764	968	554	52,357
1987	2,877	2,999	3,060	3,038	3,070	3,272	3,566	4,063	4,135	3,415	3,202	3,284	3,201	2,926	2,437	1,870	1,075	622	52,112
1992	2,764	2,893	3,023	3,088	3,083	3,131	3,318	3,591	4,060	4,104	3,353	3,097	3,101	2,898	2,481	1,810	1,139	698	51,632
1997	2,686	2,780	2,920	3,052	3,133	3,145	3,179	3,345	3,591	4,030	4,026	3,242	2,926	2,807	2,454	1,842	1,102	749	51,009
2002	2,644	2,703	2,806	2,947	3,098	3,194	3,193	3,207	3,348	3,567	3,952	3,891	3,062	2,648	2,377	1,819	1,120	744	50,320
2007	2,617	2,661	2,729	2,836	2,994	3,157	3,242	3,219	3,211	3,325	3,500	3,819	3,673	2,771	2,242	1,759	1,108	747	49,610
2012	2,580	2,635	2,688	2,758	2,883	3,055	3,206	3,268	3,224	3,192	3,266	3,384	3,606	3,320	2,345	1,660	1,071	742	48,883
2017	2,535	2,598	2,661	2,719	2,806	2,945	3,104	3,233	3,272	3,204	3,134	3,157	3,196	3,262	2,809	1,737	1,010	719	48,101
2022	2,488	2,554	2,625	2,692	2,766	2,870	2,995	3,131	3,237	3,251	3,146	3,031	2,982	2,891	2,760	2,079	1,056	684	47,238
2027	2,445	2,506	2,580	2,655	2,739	2,828	2,920	3,023	3,136	3,217	3,193	3,042	2,864	2,699	2,447	2,044	1,263	696	46,297
2032	2,414	2,463	2,533	2,610	2,704	2,801	2,879	2,949	3,029	3,119	3,158	3,088	2,875	2,591	2,285	1,812	1,243	801	45,354
2037	2,386	2,432	2,491	2,562	2,658	2,767	2,853	2,907	2,956	3,012	3,062	3,055	2,917	2,601	2,192	1,691	1,102	825	44,469
2042	2,365	2,406	2,459	2,519	2,612	2,722	2,818	2,882	2,915	2,938	2,959	2,962	2,887	2,638	2,201	1,624	1,029	762	43,698
2047	2,338	2,383	2,432	2,490	2,571	2,676	2,773	2,847	2,891	2,899	2,888	2,862	2,799	2,611	2,233	1,630	987	704	43,014

* For a fuller definition of the assumptions, see paras 5–18 of the report above

B. MALES IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	2,034	1,648	1,575	1,700	1,771	1,819	1,810	1,898	1,801	1,580	1,317	1,194	1,033	867	648	380	167	62	23,304
1952	1,975	2,026	1,657	1,588	1,724	1,798	1,833	1,810	1,879	1,765	1,518	1,236	1,079	882	675	430	198	81	24,154
1957	1,718	1,970	2,034	1,669	1,612	1,751	1,814	1,835	1,796	1 845	1,700	1,430	1,122	925	691	449	225	100	24,686
1962	1,585	1,718	1,980	2,046	1,695	1,643	1,769	1,818	1,824	1,767	1,781	1,606	1,303	967	730	464	237	113	25,046
1967	1,509	1,588	1,729	1,992	2 068	1,726	1,665	1,777	1,809	1,797	1,710	1,686	1,469	1,130	769	492	246	126	25,288
1972	1,517	1,514	1,599	1,743	2,016	2,097	1,748	1,674	1,770	1,787	1,744	1,625	1,549	1,279	903	523	263	133	25,484
1977	1,541	1,522	1,526	1,614	1,770	2,047	2,117	1,758	1,671	1,750	1,738	1,661	1,498	1,355	1,029	618	281	143	25 639
1982	1,523	1,547	1,535	1,543	1,643	1,803	2,069	2,125	1,756	1,655	1,706	1,660	1,538	1,315	1,096	707	333	155	25,709
1987	1,469	1,530	1,560	1,551	1,571	1,678	1,827	2,078	2,119	1,738	1,614	1,630	1,536	1,350	1,065	754	382	180	25,632
1992	1,411	1,476	1,542	1,576	1,580	1,607	1,702	1,838	2,072	2,097	1,695	1,542	1,508	1,350	1,093	733	407	210	25,439
1997	1,372	1,418	1,490	1,559	1,605	1,616	1,632	1,714	1,835	2,050	2,042	1,619	1,427	1,325	1,092	752	396	228	25,172
2002	1,350	1,380	1,432	1,505	1,588	1,640	1,641	1,645	1,712	1,816	1,997	1,950	1,498	1,254	1,072	750	405	225	24,860
2007	1,337	1,357	1,393	1,449	1,535	1,623	1,665	1,653	1,643	1,695	1,770	1,906	1,804	1,317	1,015	736	406	228	24,532
2012	1,318	1,345	1,371	1,410	1,478	1,571	1,648	1,677	1,652	1,628	1,653	1,691	1,763	1,583	1,065	698	398	230	24,179
2017	1,294	1,326	1,358	1,389	1,440	1,515	1,596	1,660	1,675	1,636	1,587	1,579	1 564	1,549	1,281	733	378	225	23,785
2022	1,270	1,303	1,340	1,376	1,419	1,477	1,541	1,608	1,659	1,659	1,595	1,517	1,461	1,374	1,253	881	396	215	23,344
2027	1,249	1,279	1,316	1,357	1,406	1,455	1,503	1,553	1,608	1,643	1,618	1,524	1,404	1,284	1,112	862	476	221	22,870
2032	1,233	1,257	1,293	1,333	1,388	1,442	1,481	1,516	1,553	1,593	1,602	1,546	1,411	1,234	1,039	765	466	257	22,409
2037	1,219	1,242	1,272	1,309	1,364	1,425	1,468	1,494	1,517	1,539	1,553	1,531	1,431	1,239	998	714	414	263	21,992
2042	1,208	1,228	1,255	1,288	1,341	1,401	1,451	1,482	1,495	1,502	1,502	1,485	1,417	1,257	1,003	687	387	242	21,631
2047	1,194	1,216	1,241	1,273	1,320	1,378	1,427	1,465	1,484	1,482	1,467	1,435	1,374	1,245	1,017	690	371	223	21,302

C. FEMALES IN QUINQUENNIAL AGE-GROUPS, 1947–2047

Thousands

Date (mid-year)	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85 & over	TOTAL
1947	1,937	1,591	1,530	1,657	1,760	1,827	1,840	1,941	1,865	1,743	1,577	1,430	1,285	1,101	842	539	283	136	24,884
1952	1,903	1,935	1,600	1,538	1,669	1,777	1,842	1,844	1,931	1,843	1,703	1,521	1,349	1,160	929	623	331	175	25,673
1957	1,654	1,903	1,944	1,609	1,552	1,688	1,793	1,847	1,838	1,911	1,806	1,646	1,440	1,225	985	694	388	211	26,134
1962	1,524	1,658	1,912	1,952	1,622	1,574	1,705	1,800	1,844	1,822	1,875	1,751	1,566	1,314	1,048	744	438	252	26,401
1967	1,450	1,530	1,668	1,920	1,963	1,644	1,594	1,715	1,799	1,830	1,792	1,823	1,670	1,436	1,134	798	475	291	26,532
1972	1,455	1,457	1,541	1,678	1,933	1,982	1,665	1,606	1,716	1,789	1,803	1,746	1,745	1,539	1,247	871	516	323	26,612
1977	1,478	1,463	1,469	1,552	1,693	1,954	2,002	1,678	1,610	1,709	1,766	1,761	1,676	1,615	1,345	966	568	357	26 662
1982	1,459	1,487	1,475	1,481	1,569	1,716	1,974	2,014	1,682	1,607	1,691	1,727	1,696	1,558	1,421	1,057	635	399	26,648
1987	1,408	1,469	1,500	1,487	1,499	1,594	1,739	1,985	2,016	1,677	1,588	1,654	1,665	1,576	1,372	1,116	693	442	26,480
1992	1,353	1,417	1,481	1,512	1,503	1,524	1,616	1,753	1,988	2,007	1,658	1,555	1,593	1,548	1,388	1,077	732	488	26,193
1997	1,314	1,362	1,430	1,493	1,528	1,529	1,547	1,631	1,756	1,980	1,984	1,623	1,499	1,482	1,362	1,090	706	521	25,837
2002	1 294	1,323	1,374	1,442	1,510	1,554	1,552	1,562	1,636	1,751	1,955	1,941	1,564	1,394	1,305	1 069	715	519	25,460
2007	1,280	1,304	1,336	1,387	1,459	1,534	1,577	1,566	1,568	1,630	1,730	1,913	1,869	1,454	1,227	1,023	702	519	25,078
2012	1,262	1,290	1,317	1,348	1,405	1,484	1,558	1,591	1,572	1,564	1,613	1,693	1,843	1,737	1 280	962	673	512	24,704
2017	1,241	1,272	1,303	1,330	1,366	1,430	1,508	1,573	1,597	1,568	1,547	1,578	1,632	1,713	1,528	1,004	632	494	24,316
2022	1,218	1,251	1,285	1,316	1,347	1,393	1,454	1,523	1,578	1,592	1,551	1,514	1,521	1,517	1,507	1,198	660	469	23,894
2027	1,196	1,227	1,264	1,298	1,333	1,373	1,417	1,470	1,528	1,574	1,575	1,518	1,460	1,415	1,335	1,182	787	475	23,427
2032	1,181	1,206	1,240	1,277	1,316	1,359	1,398	1,433	1,476	1,526	1,556	1,542	1,464	1,357	1,246	1,047	777	544	22,945
2037	1,167	1,190	1,219	1,253	1,294	1,342	1,385	1,413	1,439	1,473	1,509	1,524	1,486	1,362	1,194	977	688	562	22,477
2042	1,157	1,178	1,204	1,231	1,271	1,321	1,367	1,400	1,420	1,436	1,457	1,477	1,470	1,381	1,198	937	642	520	22,067
2047	1,144	1,167	1,191	1,217	1,251	1,298	1,346	1,382	1,407	1,417	1,421	1,427	1,425	1,366	1,216	940	616	481	21,712

Births, Marriages and Reproductivity, England and Wales, 1938–47

REPORT BY J. HAJNAL

CONTENTS

AUTHOR'S PREFACE

This report was written to provide a fairly thorough treatment of the problem of "replacement" and related topics to serve as a background to the less technical discussion in the Royal Commission's report. The report was drafted in January–March, 1948, and all the calculations were made during that period. The text has however been revised to some extent since then, but revision made at intervals in odd hours of leisure has not obliterated many of the imperfections of arrangement and exposition which resulted from the haste in which the report was drafted.

The circumstances in which it was written may also help to excuse other shortcomings. There is a great concentration on problems arising out of variations in the frequency of marriage. When the report was drafted the results of the special Family Census taken by the Royal Commission were not yet available. The treatment of the fertility history of recent years therefore clearly had to be provisional. It was decided to include as much as seemed needed to justify the assumptions underlying the computation of reproduction rates for England and Wales in recent years. Section B which contains this material has not been revised after information from the Family Census became available. In regard to marriage on the other hand it seemed unlikely that further data would be forthcoming. A good deal of recent work had been done by various authors on the bearing of marriage on reproduction rates and it seemed possible to treat this problem thoroughly with reference to recent developments in England and Wales.

The subject of reproduction rates has given rise to much dispute and before making calculations for England and Wales it was necessary to discuss a number of general theoretical points. This theoretical treatment, however, grew out of the problems presented by the demographic development of Britain and by the statistics available for England and Wales. Many points have only been lightly touched which would have to be dealt with at length in a more general treatment without special reference to England and Wales. The same applies to the theoretical discussion in the last section of the report.

The mathematics is restricted to Chapters VI and IX and to one or two paragraphs elsewhere. An understanding of the mathematical portion is not essential for following the rest of the report. I hope that someone with the necessary knowledge will take up the subjects which require mathematical treatment. The amateurish efforts in this report can only be a beginning.

I should like to acknowledge the help of Dr. T. N. E. Greville of the U.S. National Office of Vital Statistics who was good enough to look over the mathematics of Section D, and of Dr. P. H. Karmel who supplied copies of several of his papers in advance of publication.

Finally I must acknowledge a fundamental obligation to Mr. W. A. B. Hopkin, the Assistant Secretary of the Royal Commission. The methods of analysis and views here presented were learnt and developed in more than three years of close collaboration with him. They are his views as much as mine though he has had no share in writing this report. He has, however, written a somewhat less technical account of the "*Measurement of Reproductivity*" which is published as Appendix 3 to the Report of the Royal Commission.

J. H.

New York,
November, 1949.

INTRODUCTION

1. This report discusses problems arising out of the great and previously unexpected increase in the number of births in recent years.

2. The first section deals with the increase in the number and frequency of marriages in England and Wales in recent years. It is shown that this has been mainly due to a tendency for people to marry younger. But it is likely that a greater proportion among those now under 30 will marry in the course of their lives than among their predecessors. It is also shown that in the absence of " disturbing " factors such as migration or abnormal mortality due to war, the marriage rates and proportions married among women must be higher in the future relatively to those of men than they have been in the past.

3. Section B deals with the frequency of births in recent years. In the period 1933–39 the increase in the number of births and in certain indices of fertility was due solely to the increase in the number of marriages. During the war legitimate fertility rates first fell and then rose sharply. This increase seems to have been caused mainly by the " bunching " together over a few years of births which would normally have been spread out over a longer period in the life of the marriages concerned. The " true " level of fertility rates in recent years, i.e. apart from the effect of the " bunching " of births postponed from earlier years, would be above that of 1938, probably by at least 2 per cent. The factors which can be taken into account in the assessment of an upper limit suggest that the " true " level of fertility rates was probably less than 10 per cent. above the 1938 level.

4. Section C is devoted to an examination, by means of reproduction rates, of the long-run consequences for population growth of the frequencies of marriage and birth described in Sections A and B. Are present marriage and family-building habits such that the population must decline in the long run ? Most of Section C consists of a preliminary theoretical discussion of the meaning of various types of reproduction rates. These theoretical considerations are then applied to summarize the tendencies examined in the previous sections. The conclusion is that in spite of the changes which have taken place in the last few years the population of England and Wales would ultimately decline if people continued to marry and have children at the rates prevalent in recent years.

5. Section D discusses another question arising out of Sections A and B : if the changes in recent years consisted mainly in earlier marriage ages and the making up of " postponed " births, how are the very large increases in the absolute numbers of marriages and births to be explained ? This question involves a general theoretical problem of the effect of changes in the distribution of demographic phenomena over the life cycle of individuals. Section D is largely taken up with the analysis of this problem.

SECTION A.—MARRIAGES

CHAPTER I—THE FREQUENCY OF MARRIAGE—GENERAL FEATURES, COMPARISON WITH 1914–18 WAR

6. A striking feature of recent demographic developments which is obviously associated with the increase in the number of births is the rise in the number of marriages. The total number of marriages occurring in England and Wales in the years since 1924 is summarized in averages for three year periods in Table 1.

TABLE 1

Number of Marriages, England and Wales, 1924–47

Period	Average annual marriages (000's)
1924–26 . .	290·7
1927–29 .	308·3
1930–32 . .	311·3
1933–35 . .	336 7
1936–38 .	358·5
1939–41 . . .	433 1
1942–44 . .	322·3
1945–47 . .	394 3

7. A slight rising tendency can perhaps be detected in the figures up to 1932. Thereafter there was a rapid increase. In 1938 the number of marriages was 118 per cent. of the 1932 figure.

8. The figures for the years since 1939 reflect the influence of the war. The beginning of the war was followed by a spurt in marriages which continued through 1940. In the later years of the war the number of marriages was fairly low. After the end of the war there was another marriage boom which has not definitely come to an end yet. Very similar movements occurred during the war of 1914–18. The developments in the two wars are compared in Table 2, where the number of marriages in each year of the war and the

TABLE 2

Number of Marriages in the two Wars

First-War Period			Second-War Period		
Year	Annual marriages (000's)	Indices 1911–13=100	Year	Annual marriages (000's)	Indices 1936–38=100
1911–13 ... (average)	281 8	100	1936–38 ... (average)	358·5	100
1914 ..	294·4	104	1939 ...	439·7	123
1915 ..	360·9	128	1940 ...	470·5	131
1916 .	279·8	99	1941 . .	388·9	108
1917 ...	258·9	92	1942 ..	369·7	103
1918	287·2	102	1943 ...	296·4	83
1919 ..	369·4	131	1944 ...	302·7	84
1920 . .	380·0	135	1945 . .	397·6	111
1921 .	320·9	114	1946 ...	385·6	108
1922 ..	299·5	106	1947 ...	(399·9)[1]	111
1923 ...	292·4	104			

[1] Provisional.

immediate post-war period is expressed as a percentage of the average number of marriages in the three years previous to the war.

9. It will be seen that in the war of 1914–18 the second peak (1919–21) was larger than the first (1914–15). In the war of 1938–45 on the other hand the first peak was far larger than the second.

10. In order to draw conclusions about changes in the *frequency* of marriage it is, however, necessary to relate the number of marriages to the number of unmarried persons. Choosing as a suitable general index the number of marriages of women aged 20–39 per 1,000 unmarried women (single, widowed or divorced) we obtain the following table which again compares the two war periods.

TABLE 3

Marriages of Women aged 20–39 per 1,000 unmarried Women of that Age

First-War Period			Second-War Period		
Year	Marriage rate	Indices 1911–13=100	Year	Marriage rate	Indices 1936–38=100
1911–13 (average)	90 4	100	1936–38 (average)	114·8	100
1914	94·1	104	1939	148·3	129
1915	116·9	129	1940	164 6	143
1916	89 3	99	1941	135·6	118
1917	80·0	88	1942	129·4	113
1918	86·8	96	1943	101·3	88
1919	112·2	124	1944	105·2	92
1920	119·0	132	1945	144·9	126
1921	99·0	110	1946	149·2	130
1922	93·1	103			
1923	90·9	101			

11. It will be seen that marriage rates in recent years were higher throughout than in the corresponding periods of the 1914–18 war. Moreover in terms of marriage rates the peak in 1945–47 was about as high as that of 1939–41.

Reduction in Population of Marriageable Age

12. The reason why the high rates of the last few years have nevertheless resulted in a far smaller number of marriages than occurred in the early war years, is to be found in a decline in the population " available for marriage ", that is the numbers of young unmarried persons. Data bearing on this question and comparing the period of the recent war with the period 1911–21 are set out below in Table 4.

13. It will be seen that a part of the fall in the number of young unmarried persons in the period 1939–47 was due to a decline in the total population in the marriageable age groups. In 1947 there were about 7 per cent. fewer men and 8 per cent. fewer women aged 15—34 than in 1939. At the same time the proportion of young persons unmarried declined also, by about 7 per cent. for men and 14 per cent. for women. As a result the number of non-married men aged 15–34 declined by 14 per cent. and that of non-married women at that age by 21 per cent. There are in fact now fewer unmarried women aged 15–34 in England and Wales than at any time since 1881, when the total population of the country was only 60 per cent. of its present size. The war of 1914–18 was not accompanied by a comparable reduction in the population available for marriage.

TABLE 4

Changes in the Population available for Marriage in the two Wars

Change in Period 1911–21 | Change in Period 1939–1947(1)

MALES

I. All Conjugal Conditions

Thousands

Age Group	15–19	20–24	25–29	30–34	Total 15–34
1911 .	1,655	1,503	1,456	1,376	5,990
1921 ..	1,728	1,448	1,340	1,281	5,797
Per cent. Change	+ 4 4	− 3·7	− 8·0	− 6 9	− 3·2

Age Group	15–19	20–24	25–29	30–34	Total 15–34
1939 .	1,806	1,493	1,704	1,698	6,701
1947 .	1,463	1,533	1,613	1,632	6,241
Per cent. Change	−19 0	+ 2·7	− 5 3	− 3 9	− 6·9

II. Non-Married Men

Thousands

1911 ..	1,652	1,290	724	391	4,057
1921 ...	1,721	1,193	607	312	3,833
Per cent. Change	+ 4 2	− 7 5	−16 2	−20 2	− 5 5

1939 ...	1,793	1,234	784	385	4,196
1947 . .	1,451	1,205	648	326	3,630
Per cent. Change	−19 1	− 2 4	−17 3	−15·3	−13·5

III. Proportion Non-Married

1911 ..	9982	·8583	·4973	2842	6773
1921 . .	9959	8239	·4530	·2436	6612
Per cent. Change	− 0 2	− 4·0	− 8·9	−14·3	− 2 4

1939 .	·9928	·8265	4601	2267	6262
1947	·9918	·7860	·4017	1998	5816
Per cent. Change	− 0·1	− 4·9	−12·7	−11·9	− 7·1

(1) In studying the figures for 1939–1947 in this table, and all other figures in this paper relating to the marital status of the population in years after 1931, it must be remembered that post-censal estimates of the population by marital status are subject to a considerable degree of uncertainty. In the present instance this uncertainty is considerably greater for the male population. The female population in England and Wales was completely enumerated at the National Registration of 1939. About 900,000 non-civilian males were omitted from the National Register, so that for the male population there is no direct check on marital status since the 1931 census The interpretation of the marital status data for men is also complicated by the fact that all population estimates since 1939 include members of the armed forces and merchant seamen abroad while figures for previous years do not include this element. In mid-1939 the number of members of the armed forces and merchant seamen abroad is estimated to have been 180,000. The comparability of proportions married is affected by this change only to the extent that the composition by marital status of the section of the population excluded before 1939 may have been different from the composition of the general population.

FEMALES

I. ALL CONJUGAL CONDITIONS — Thousands

Age Group	15–19	20–24	25–29	30–34	Total 15–34	Age Group	15–19	20–24	25–29	30–34	Total 15–34
1911 .	1,682	1,673	1,623	1,501	6,479	1939 . .	1,797	1,505	1,763	1,763	6,828
1921 ...	1,775	1,703	1,620	1,520	6,618	1947	1,441	1,541	1,645	1,656	6,283
Per cent. Change	+ 5·5	+ 1·8	− 0 2	+ 1 3	+ 2 1	Per cent. Change	−19·8	+ 2 4	− 6·7	− 6·1	− 8·0

II. NON-MARRIED WOMEN — Thousands

1911 .	1,662	1,269	717	434	4,082	1939 .	1,746	989	612	453	3,800
1921 .	1,744	1,243	699	460	4,146	1947	1,388	858	429	321	2,996
Per cent. Change	+ 4·9	− 2·0	− 2 5	+ 6 0	+ 1 6	Per cent. Change	−20·5	−13·2	−29·9	−29·1	−21·2

III. PROPORTION NON-MARRIED

1911 .	9881	7585	·4418	2891	6300	1939 . .	9716	·6571	·3471	2569	·5565
1921 ...	9825	7299	·4315	3026	6265	1947 ..	·9632	5568	2608	·1938	·4768
Per cent. Change	− 0·6	− 3 8	− 2·3	+ 4 7	− 0 6	Per cent. Change	− 0·9	−15·3	−24·9	−24·6	−14 3

Proportions married

14. The changes of recent years must be viewed in the light of the experience of the more remote past. The easiest means for doing this is to trace the course of the proportions of the population in each sex-age group who are or have been married (called the proportions ever married). It is simpler to analyse the proportions ever married than the proportions married. The proportions ever married are an index of the frequency of first marriages. Owing to the changing rates of dissolution of marriage and changing rates of remarriage the proportions married reflect a very complicated situation. The proportions ever married can be taken as an index of the incidence of first marriage only in so far as mortality and migration are not very heavy or do not differ much in their incidence on the single and on the married. In fact it is known that both mortality and migration remove a larger percentage of the single population than of the married population; therefore at the higher ages the proportions ever married are higher than they would be if they were the result of marriage habits alone. Small changes in them over long periods of time cannot be taken as an indication of changing marriage habits; they may be an indication of a change in the incidence of mortality and migration. The general features of the table below cannot however be affected to any great extent by this disturbing factor. For the difference which the heavier mortality of the single makes to proportions ever married at the present day, see *Computational Note I*, Table B and *Note II* Table D. It will be seen

that for women the difference is negligible at the important ages (say under 55). At these ages the difference is fairly small even for the male population. Figures of this kind are available for England and Wales since the census of 1851. Figures for every census date since 1851 and for 1939 and 1947 are shown in Table 5.

TABLE 5

Proportions of Population ever married by Age Groups (per cent)
England and Wales, 1851–1947

	1851	1861	1871	1881	1891	1901	1911	1921	1931	1939	1947
						Males					
15–19	0·4	0·5	0·6	0·5	0·4	0·3	0·2	0·4	0·3	0·7	0·8
20–24 .	20·3	22·5	23·3	22·3	19·5	17·4	14·3	17·8	13·9	17·4	21·5
25–34	64·4	68·2	68·4	68·3	65·7	64·1	61·4	65·9	64·8	66·3	70·5
35–44 ..	83·8	85·8	86·3	86·2	85·3	84·2	83·1	85·0	87·5	86·6	89·6
45–54 ...	88·5	89·5	90·3	90·4	90·0	89·0	87·8	88·0	89·2	90·5	91·4
						Females					
15–19 ...	2·5	3·1	3·2	2·5	1·9	1·5	1·2	1·8	1·8	2·9	3·7
20–24 .	31·3	33·3	34·8	33·5	29·9	27·4	24·3	27·4	25·8	34·4	44·8
25–34 .	67·1	69·5	71·1	70·7	67·4	66·0	64·5	66·3	67·0	71·0	79·2
35–44 ...	83·7	84·1	84·4	84·6	83·6	81·5	80·4	80·8	80·6	81·1	83·1
45–54 ...	87·8	88·1	87·9	88·1	87·6	86·6	84·2	83·6	83·6	83·3	84·0

Table 5 shows three distinct movements:

(1) The proportions married increase for both sexes from 1851 (the first census at which information became available) to 1871; the maximum was reached in 1871 and 1881.

(2) After that period the proportions fall until 1911.

(3) Between 1911 and 1947 there has been a striking rise.

15. Two features of these figures may be specially emphasized. First, the changes in the proportions ever married have not been entirely the same in the two sexes. Among women the decline occurring between 1881 and 1911 was far heavier than it was among men, both proportionately and absolutely. Similarly the rise in the recent period has been far heavier both proportionately and absolutely among women than among men. Secondly, the figures must be examined in the light of a distinction which is fundamental to the study of population growth, namely the distinction between changes in the age at marriage and changes in the proportions of persons who marry in the course of their lives. This distinction is of great importance both because the effects of the two sorts of changes on population growth are very different (see Sections C and D below), and because far greater changes occur in the age at marriage than in the proportions of persons who ultimately marry.

16. The second proposition is well illustrated by the figures in Table 5. The proportion of persons married in the age group 45–54 may be taken as a rough index of the proportions of persons who marry once or more in the course of their lives. It will be seen that among men this proportion varied very little. It was 87·8 per cent. at its lowest and 91·4 at its highest. At the younger ages changes in proportions married were more pronounced. For example, at ages 20–24 among men the maximum experienced was over 23 per cent., while the minimum was under 14 per cent. In fact the movements summarized in the last paragraph were all mainly movements in the age at marriage.

17. The recent increases in the proportions ever married are shown by Table 5 to be the culmination of a movement which has been going on for some 30 years. This movement was greatly accelerated after 1931 and particularly after 1939 in the period of the war. Since the movement has consisted mainly in a rapid rise in the proportions ever married at the young ages—among women 20–24 in 1947 45 per cent. were or had been married as against the previous maximum of 35 per cent.—it would seem that in the main we have been witnessing mainly a lowering of the age at marriage. The proportion of persons married in the age groups over 30 has hardly shown any signs of change.

Marriage Rates

18. At all but the youngest ages, the proportions of persons married at any time are mainly the consequence of the marriage frequencies which were in operation some time ago. To obtain full information on present marriage tendencies the study of proportions married must be supplemented by the study of marriage rates. A short digression is therefore required.

19. The marriage rates of bachelors and spinsters by age groups are shown in index form in Table 6. The rates for the year 1938 have been taken as 100(1).

TABLE 6

Marriage Rates of Bachelors and Spinsters
Indices 1938 = 100

BACHELORS

Year	15–19	20–24	25–34	35–44	45–54	55 and over
1932 .	106	80	84	85	83	100
1938 ..	100	100	100	100	100	100
1939 ..	144	138	119	113	107	106
1940 .	185	154	135	123	124	111
1941	232	136	106	120	123	116
1942 ...	261	143	94	118	119	111
1943 .	249	116	70	102	104	97
1944 ..	232	117	68	96	110	83
1945 ...	251	149	99	123	124	110
1946 .	193	127	107	136	128	115

SPINSTERS

Year	15–19	20–24	25–34	35–44	45–54	55 and over
1932 .	79	72	80	81	87	100
1938 ..	100	100	100	100	100	100
1939 ...	142	132	120	112	108	100
1940 ...	171	152	129	122	113	103
1941 ..	161	129	100	111	111	95
1942 ...	173	128	86	107	112	98
1943 ...	152	96	68	91	107	89
1944 ..	147	98	70	89	107	91
1945 ...	178	135	102	109	123	107
1946 ...	153	130	111	121	132	114

(1) For years previous to 1939, the estimates of the male population exclude members of the armed forces and merchant seamen abroad, for years since 1939 they are included. Only for 1939 are estimates available on both these bases. The indices given below for bachelors for 1940 and later years were obtained by first dividing the marriage rate of the year by the comparable 1939 rate, and then multiplying the quotient by 100 times the ratio to the 1938 rate of the 1939 "old basis" figure.

20. Table 6 shows that marriage rates increased sharply between 1932 and 1938. Then followed the fluctuations connected with the war which have been discussed above. Between 1932 and 1938, the increases in marriage rates were steepest at the young ages, and marriage rates of spinsters rose far more than those of bachelors.

21. The marriage booms during the war have resulted in even more pronounced increases at the younger ages. A rise in the marriage rates of women relative to those of men is not, however, pronounced during the war period.

22. To visualize the effect, in terms of proportions married, of the maintenance of a given level of marriage rates, the device of the nuptiality table may be used. By the application of life-table technique, we may trace the fate, from their birth, of a cohort of persons who are supposed to be subjected at each age to the mortality and marriage rates of the single in a certain period. We may thus compute the numbers who would survive at each age and remain unmarried. The number of unmarried survivors in such a net nuptiality table may be subtracted from the stationary population of the same age to obtain the number of persons at that age who are or have at any time been married. The proportion ever married may be obtained by dividing this figure by the stationary population in that age group.

23. Table 7 shows the result of such a calculation for the marriage rates of bachelors and spinsters for 1938 and for the mean of the marriage rates from mid-1942 to mid-1947(1). The mortality is that of 1938–39(2). The actual proportions ever married as estimated for 1938 and 1947 have been added for comparison.

24. At ages under 25 the effects of a change in marriage rates on proportions married are soon visible, and the proportions actually recorded for 1938 are close to those resulting from the permanent maintenance of 1938 marriage rates. The correspondence between the results of the maintenance of 1942–47 marriage rates and the proportions married actually recorded in 1942–47 is, of course, even closer, since few of those under 25 in 1947 had been married before 1942.

TABLE 7

Proportions ever married (per cent.)

I. Men

Age Group	1938 Nuptiality	1942–47 Nuptiality	Actual 1938	Actual 1947
15–19	0·3	0·8	0·6	0 8
20–24	16·8	21 4	16 9	21·5
25–29	58·5	60 0	54 3	60·2
30–34	81·5	79·5	77·4	80 8
35–39	88·7	87 5	84·9	88·5
40–44	91·4	90 9	88·8	90 7
45–49	92 8	92 7	90 4	91·3
50–54	93·5	93·3	90·3	91 5
55–59	94·0	93·7	90·1	91·5
60–64	94·4	94 1	90·2	91·5

(1) For details of the method of calculation of the nuptiality tables, see *Computational Note II*. The figures in Table 7 for the proportions ever married resulting from 1938 female nuptiality may be obtained directly from Table E, by dividing the figures in column (6) of that table by those in column (5)

$$\text{e.g. } \frac{1{,}351}{46{,}238} = \cdot 029, \qquad \frac{16{,}006}{45{,}783} = \cdot 350, \text{ etc.}$$

(2) The proportion ever married is affected by mortality only to the extent that the stationary population according to the mortality of the single population differs from the stationary population according to general mortality.

II. WOMEN

Age Group	1938 Nuptiality	1942–47 Nuptiality	Actual 1938	Actual 1947
15–19 ...	2·9	3·7	2 2	3 7
20–24 . .	35·0	44·7	32·5	44·8
25–29 . .	71·1	76·5	64·9	75·5
30–34	83·5	85·0	74·9	82·8
35–39 . . .	87·0	88·1	80·1	83·5
40–44 . . .	88·5	89·4	82·0	82·6
45–49 . .	89·3	90·1	83·0	83·7
50–54	89·8	90 8	84·0	84 4
55–59	90·1	91·2	84·4	84·6
60–64 . . .	90·2	91 3	84·4	84·5

At the older ages, on the other hand, the proportions married resulting from the maintenance of 1938 nuptiality would considerably exceed those actually recorded in 1938.

25. This raises a doubt as to the propriety of characterizing the marriage habits of the population in 1938 by the marriage rates of 1938, or at any rate in regard to the propriety of " projecting " the marriage rates of a given year into the future. In a community in which 1938 marriage rates had been in force for some time, a smaller proportion of those at older ages would remain unmarried than were unmarried in the 1938 population. Those who would remain unmarried under these conditions would perhaps be less " marriageable " on average than were those who remained unmarried at the older ages in England and Wales in 1938. On this assumption the maintenance of *attitudes* to marriage similar to those of 1938 would bring a gradual decline below the 1938 level in the marriage rates at higher ages.

26. Does this argument apply to the period 1942–47? Among men under 40 the proportions ever married in 1947 exceeded those resulting from the maintenance of the rates of 1942–47. At ages over 40, the proportions ever married in 1947 were slightly lower than those yielded by 1942–47 nuptiality. On the whole, however, the two series of figures agree fairly closely. In the case of women the proportions yielded by 1942–47 rates exceed those actually achieved in 1947 by a considerable margin at ages over 30. But the proportions ever married recorded in 1947 are clearly of a temporary nature. For a greater percentage of the women aged 35–39 had been married, than of women aged 40–44. This is because the latter group of women passed through the ages at which marriage is most frequent at a period when marriage rates were lower than they subsequently became. As the groups of women who have experienced heavier marriage rates grow older the proportions married in the age groups over 30 must rise above the 1947 level.

Conclusion

27. We may conclude therefore that the cohorts(1), which are now of prime marriageable age, are marrying earlier than their predecessors. It seems likely that the proportion of men who will marry (once or more) in the course of their lives will be slightly higher than among their predecessors. Among women, the proportions who marry in the course of their lives will certainly rise considerably higher than in the recent past.

(1) The word cohort is used in the present paper to denote a group of persons who were born (or married) in the same period. It may denote an actual group or a hypothetical one, supposed to be subjected to certain rates (as in a life-table). A real group of persons has often been denoted by the word " generation ", but this term is here reserved to the special sense it bears in connection with the stable population (see para. 139 below).

CHAPTER II.—THE SUPPLY OF MEN AND WOMEN OF MARRIAGEABLE AGE

The Ratio of Men to Women in the Population

28. Changes in the marriage rates of one sex relative to the marriage rates of the other sex depend on the relative supply of men and women in the population. Table 8A shows the number of women per 1,000 men of the same age at various dates. This type of comparison does not, however, give a complete indication of the changes in the relative supply of men and women which are relevant to marriage rates. For men tend to marry women younger than themselves. To show the supply of slightly younger women to men of various age groups Table 8B gives the number of women per 1,000 men 5 years older at various dates.

29. As Table 8A shows, there were throughout the second half of the 19th century and at the beginning of the 20th century considerably more women than men in most of the prime marriageable age groups(1). Between 1911 and 1921 the excess mortality caused by the war considerably increased the surplus of women. Thereafter the ratio of women to men declined.

30. The figures in Table 8A for 1939 are lower for all age groups under 35 than in any previous year covered in the table. Between 1939 and 1947 there is relatively little change in the figures.

31. Up to and including 1911, every figure in Table 8B is higher than the corresponding figure in Table 8A. The excess of women was always greater in relation to the numbers of slightly older men than in relation to the numbers of men in their own age groups. This is partly a result of mortality, but mainly due to the fact that the number of births was continuously increasing, and in Table 8B the number of women in an age group are related to the survivors of earlier, and therefore smaller, contingents of births than those to which they themselves belonged. On this account the cessation of population growth also contributed to making the structure of the population by age and sex more favourable for women's chances of marriage to-day than at any time in the last hundred years.

32. It will be seen that at the younger ages the ratio of women to men fiv years older changed fairly sharply in some groups between 1939 and 1947. This is due to past irregularities in the movement of the number of births. For example, the survivors of the abnormally low numbers of births in 1915–18 were in 1939 all aged 20–24. Correspondingly the figure for the age group 20–24 in 1939 in Table 8B is very low. On the other hand, in 1947 the survivors of these generations were divided between the age groups 25–29 and 30–34. Accordingly the effect of this wave in the number of births no longer results in a figure which stands out so completely from the rest as that of 884 in 1939.

33. The final columns of Table 8 show the ratio of men to women as it would be in a population recruited by a constant number of births (assuming 1,051 male births per 1,000 female births) and subject to the mortality of 1938–39. It will be seen that in such a population women would be far scarcer in relation

(1) The table is based on the populations enumerated at the censuses. There is some reason to suspect that the ages of women are particularly liable to misstatement and it is possible that the specially marked surplus of women between 20 and 30 is due to misstatement. However, the general features of the table and the movement over time cannot be due to such errors. Cf. V. P. A. Derrick, " Observations on (1) Errors of Age in the Population Statistics of England and Wales and (2) Changes in mortality indicated by the National Records ", *Journal of the Institute of Actuaries*, Vol. *LVIII*, Part 2, July 1927, pp. 117 and 136.

TABLE 8

A. Females per 1,000 Males of same age

Age Group	1851	1861	1871	1881	1891	1901	1911	1921	1931	1939A	1939B(1)	1947(1)	Stationary Population according to 1938–39 Mortality
0– 4	995	993	999	1,003	1,002	1,003	991	976	980	961	961	950	965
5– 9	992	998	1,004	1,007	1,005	1,005	1,001	992	980	977	977	963	967
10–14	985	986	986	997	1,001	1,000	1,003	992	979	989	989	972	968
15–19	1,012	1,018	1,010	1,008	1,014	1,019	1,016	1,027	1,009	995	979	985	969
20–24	1,095	1,127	1,106	1,093	1,122	1,119	1,113	1,176	1,057	1,008	973	1,005	971
25–29	1,103	1,137	1,111	1,087	1,115	1,126	1,115	1,209	1,061	1,035	1,016	1,020	973
30–34	1,065	1,096	1,090	1,077	1,073	1,100	1,091	1,186	1,132	1,038	1,025	1,015	974
35–39	1,044	1,075	1,093	1,069	1,059	1,074	1,072	1,156	1,185	1,049	1,037	1,015	977
40–44	1,043	1,058	1,084	1,079	1,075	1,062	1,077	1,127	1,167	1,184	1,174	1,017	982
45–49	1,034	1,053	1,077	1,103	1,082	1,070	1,079	1,070	1,152	1,177	1,171	1,069	990
50–54	1,048	1,057	1,073	1,104	1,111	1,089	1,086	1,074	1,133	1,171	1,166	1,193	1,007
55–59	1,065	1,054	1,076	1,111	1,139	1,116	1,103	1,086	1,095	1,174	1,170	1,196	1,035

B. Females per 1,000 Males 5 Years Older

Age Group of Women	1851	1861	1871	1881	1891	1901	1911	1921	1931	1939A	1939B(1)	1947(1)	Stationary Population according to 1938–39 Mortality
0– 4	1,115	1,147	1,136	1,124	1,050	1,070	1,038	929	882	980	980	1,188	981
5– 9	1,081	1,105	1,111	1,126	1,056	1,046	1,058	954	1,015	916	916	995	975
10–14	1,087	1,091	1,109	1,102	1,101	1,039	1,059	1,055	928	836	823	932	976
15–19	1,111	1,133	1,151	1,150	1,191	1,113	1,119	1,226	1,015	1,204	1,162	940	981
20–24	1,246	1,320	1,249	1,239	1,259	1,241	1,149	1,271	1,102	884	867	955	984
25–29	1,248	1,262	1,256	1,270	1,267	1,292	1,180	1,265	1,206	1,038	1,026	1,008	987
30–34	1,236	1,228	1,270	1,215	1,213	1,231	1,190	1,193	1,264	1,117	1,105	963	991
35–39	1,172	1,151	1,187	1,184	1,229	1,238	1,257	1,203	1,236	1,274	1,263	1,049	999
40–44	1,258	1,286	1,262	1,327	1,248	1,254	1,250	1,186	1,209	1,257	1,249	1,160	1,015
45–49	1,173	1,218	1,198	1,243	1,264	1,278	1,301	1,281	1,225	1,256	1,251	1,295	1,043
50–54	1,423	1,386	1,413	1,404	1,477	1,392	1,372	1,335	1,281	1,280	1,276	1,302	1,089

(1) The second set of figures given for 1939 and the figures for 1947 are based on estimates of the male population which include members of the armed

to the number of men than they have been even in recent years. Indeed the large surplus of women in former times was not the consequence of the normal excess mortality of men. It was the result of migration and war(1). Changes in the ratio of male to female births and in mortality have had relatively little effect in reducing the surplus of women in recent years. The reduction was due mainly to the changing incidence of migration. In the absence of war and migration the ratio of women to men of the same age must in the future be far lower than it has been in the past. The ratio of women to men older than themselves must also be far lower unless the number of births were to be continuously and rapidly increasing, and this is most unlikely.

Measuring the Compatibility of Male and Female Marriage Rates

34. How will the marriage rates at present in operation have to change in view of the changing structure of the population by age and sex ? This question may be answered by means of nuptiality tables. As mentioned above, on the basis of the death rates and marriage rates of any one period two nuptiality tables may be calculated, one by using the marriage rates of men and the other by using the marriage rates of women. It is obvious that at any time the number of men marrying must be equal to the number of women marrying(2). When nuptiality tables are calculated for modern European populations, it usually appears quite clearly that the marriage rates of men and those of women could not both be maintained indefinitely in the absence of war or migration, for unless the population of men is abnormally reduced by special agencies of this kind, the current nuptiality rates of men would result in far more marriages than the rates of women. In this sense these marriage rates were in the long run "incompatible". Such a situation is to be expected if the ratio of women to men in the population at the time when the marriages are recorded is not such as could be maintained apart from migration.

35. In measuring precisely the extent of the adjustment necessary to bring the marriage rates of the two sexes into harmony in a population not subject to war or migration two difficulties are however encountered. For a nuptiality table based on male nuptiality may be perfectly "compatible" with one based on female nuptiality even if the number of marriages shown by the one differs from that shown by the other. In the first place, the fact that men marry women who are on average younger than themselves, means that in an increasing population it is possible to have more men of each generation getting married than among women, as has been explained above. The opposite holds good for a decreasing population. If, as is at present the case in England and Wales, births have in the recent past been neither increasing nor decreasing continuously, simple comparisons between the total numbers of marriages in the two nuptiality tables have no precise significance. Secondly, it is not necessary that at any one time the number of marriages of bachelors should equal the number of marriages of spinsters. In fact spinster marriages form a larger proportion of the marriages of women than do bachelor marriages of the marriages of men. Even for the case of a stationary population it is not

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(1) Cf. J. Hajnal, "Aspects of Recent Trends of Marriage in England and Wales," *Population Studies*, Vol. I, No. 1, 1947, p. 87. P. H. Karmel, "An Analysis of the Sources and Magnitudes of Inconsistencies between Male and Female Reproduction Rates in actual Populations," *Population Studies*, Vol. II, No. 2, 1948.

(2) It is also possible, though somewhat more laborious, to compute the numbers of married men and women in the stationary populations resulting from the marriage rates in question. If the rates are "compatible" these numbers must be equal. This procedure has been applied by Leo Tornquist to the marriage rates of Sweden and Finland (see "En befolknings statistisk jämförelse mellan Finland och Sverige", *Ekonomiska Samfundets Tidskrift*, 3rd series, Vol. I, 1948, No. 3).

possible to say whether a nuptiality table for men is compatible with one for women unless both tables give not only the number of first marriages (as is usual in nuptiality tables) but also the number of remarriages.

36. The first difficulty may be avoided for the present by confining consideration to a stationary population. It is taken up in para. 48 below.

37. A full solution of the second problem would involve the calculation of the rate of dissolution by death or divorce of the first marriages given by the nuptiality table, a calculation of the number of widowed and divorced persons in a stationary population and of their marriages. The nuptiality of a given year would thus be defined not only by the mortality of the single and rates of first marriage, but also by rates of divorce and widowhood and the marriage rates of widowed and divorced persons. A full calculation on these lines would be extremely laborious. Moreover, as regards England and Wales there are very serious gaps in the basic data, in particular in regard to divorce. In any case the number of remarriages is relatively small and it is doubtful whether highly refined calculations would be justified. So the following simple method has been adopted for finding the number of remarriages in the stationary population. The total number of marriages of widowers and divorced men in each age group were related to the total of married, widowed and divorced men in the age group. These rates were applied to the numbers of persons ever married in each age group in the nuptiality table. This procedure would yield the same number of remarriages as the more elaborate procedure outlined above if in each age group in the actual population the ever-married were divided between the categories 'married' and 'widowed and divorced' in the same proportion as would result from the operation of current rates of death and divorce. In view of the small number of remarriages the error in this simple computation can hardly be serious, and it does at any rate make the number of remarriages at each age vary with the number of first marriages at younger ages.

38. The results of a calculation of this kind based on pre-war data are presented in Table 9. Bachelor and spinster marriage rates and remarriage rates as defined above have been used. The mortality is that of 1938–39.

TABLE 9

Marriages in a Stationary Population subject to 1938 Male and Female Nuptiality

Age Group	Male Nuptiality (l_0 = 5,124)			Female Nuptiality (l_0 = 4,876)		
	First Marriages	Subsequent Marriages	All Marriages	First Marriages	Subsequent Marriages	All Marriages
15–19 ..	74	—	74	481	—	481
20–24 ..	1,650	3	1,653	2,108	6	2,114
25–29 ..	1,662	20	1,682	985	26	1,011
30–34 ...	523	46	569	240	43	283
35–39 ...	172	60	232	92	49	141
40–44 ..	69	67	136	40	45	85
45–49 ...	35	67	102	23	42	65
50–54 ...	17	66	83	13	34	47
55–59 ...	9	62	71	7	25	32
60–64 ...	5	52	57	4	18	22
65–69 ...	2	42	44	3	16	19
70–74 ...	1	24	25	1	7	8
75–79 ..	1	11	12	—	2	2
80–84 .	—	4	4	—	—	—
All Ages ...	4,220	524	4,744	3,997	313	4,310

39. A word of explanation may be needed in regard to the radix adopted. In 1938 there were 1,051 male for every 1,000 female births. 10,000 births divided in this proportion would consist of 5,124 male births and 4,876 female births. These two numbers have therefore been used respectively as the radix of the male and female nuptiality table. This is particularly convenient in connection with reproduction rates. (See Section C below.)

40. Table 9 shows that in a stationary population recruited from 5,124 male births, there would occur, if the marriage rates experienced by men in 1938 were in operation, 4,220 first marriages and 524 remarriages. In a stationary population recruited from 4,876 female births and subject to the 1938 marriage rates of women, there would be 3,997 first marriages and 313 remarriages. In 1938, 92·9 per cent. of the marriages of men were marriages of bachelors and 94·4 per cent. of the marriages of women were marriages of spinsters. In Table 9 the corresponding proportions are 89·0 and 92·7.

41. As may be seen from Table 9, it would not be possible for both the sets of rates on which the table was based to remain in operation indefinitely in a stationary population (in the absence of "external" disturbances such as migration). It would be necessary for fewer men or for more women to marry in each generation. It is clear that the required adjustment is most unlikely to be achieved by changes in the number of widowed and divorced persons remarrying. It follows that the chance of first marriage for women must be raised or that for men lowered. In Table 9 there are 10 per cent. more marriages of men than marriages of women. On the other hand Table 7 shows that even according to 1938 female nuptiality there would be more than 90 per cent. of women ever married and this (as may be seen from Table 6) is a very high proportion in relation to the past experience of England and Wales as well as in relation to experience abroad. It would, therefore, be highly unlikely that the considerable adjustment of nuptiality from the 1938 level which would be required if the population were to assume the sex-age structure of the stationary population would be achieved entirely by changes in the marriage rates of women. Marriage rates of men would have to fall below the 1938 level.

42. Since, as Table 8 showed, the sex-age structure of England and Wales at earlier times was even more "abnormal" than in 1938, it would be expected that the marriage rates of the two sexes in earlier times would be even less consistent in a stationary population than those of 1938. This is in fact the case. The position since 1938 may be gathered from Table 10, which shows the total number of marriages in a stationary population subject to the nuptiality of men and women in 1938 and 1942–47.

The Compatibility of Proportions ever married

43. It was suggested above (para. 25) that the method of characterizing the marriage habits of a period by the marriage rates at separate ages is open to doubt. We may, therefore, proceed to investigate how the proportions ever married of a given period would be compatible if the sex and age structure of the population were to become normal. For this purpose we may compute the number of marriages which would occur in a stationary population in which in each age group the proportion single was that recorded for, say, men in England and Wales in 1938. A similar calculation may be carried out for the proportions single among women. The total number of marriages resulting from the proportions married among the two sexes may then be compared, as shown above in the case of marriage rates. In making the comparison the problem of allowing for remarriages arises, as it did for

nuptiality tables, since the proportions ever married only determine the number of first marriages in the stationary population. The number of remarriages has been computed in the calculations presented below, by the same method as was described in paragraph 37 in connection with Table 9.

44. A special problem arises, however, in deriving a distribution of marriages in a stationary population from proportions ever married. As pointed out in paragraph 26, the proportions married obtaining at a given date are sometimes such that they could not be supposed to be experienced by one generation in the course of their lives. This was clearly the case for example in 1947, when more women aged 35–39 had been married than had been married among those aged 40–44. Where the proportions married at the older ages were unsuitable, the 1938 rates of first marriage were used to complete the calculation of marriages in the stationary population. Since the majority of first marriages occur at the younger ages, the choice of a particular set of marriage rates at the older ages has but a very slight effect on the total number of marriages at all ages. The 1938 proportions married were abandoned, and the 1938 rates used, at ages 50 for men and 45 for women. In the calculations based on the 1947 proportions, the 1938 rates were used after age 40 for men and 30 for women.

The Figures for Recent Years

45. Several calculations of marriages in a stationary population by the various methods just discussed are assembled in Table 10 (1). All the calculations were based on the 1938–39 life table. The rates of remarriage used are those of 1938 throughout. Since the remarriage rates here used are rates for persons ever married, it would not have been appropriate to use wartime rates. For as a result of the war an abnormally high proportion of ever married women were widows and consequently exposed to the risk of remarriage. The numbers appearing in Table 10 have been related as in Table 9 to unusual radices derived from the proportionate distribution of births by sex.

TABLE 10

Marriages of Men and Women in Stationary Population according to 1938–9 Mortality

(Radices 512 Male Births, 488 Female Births)

I. MEN

Age Group	1938 Nuptiality	1938 Proportions Single	1942–47 Nuptiality	1947 Proportions Single
15–19	7	8	21	21
20–24	165	150	165	165
25–29	168	164	151	155
30–34	57	58	54	55
35–39	23	26	23	23
40–44	14	16	16	14
45–49	10	11	11	10
50–54	8	9	8	8
55 and over	21	21	21	21
Total	474	462	472	472

(1) Notes on computational procedure will be found in *Note II.*

II. WOMEN

Age Group	1938 Nuptiality	1938 Proportions Single	1942–47 Nuptiality	1947 Proportions Single
15–19	48	39	80	80
20–24	211	197	212	209
25–29	101	92	82	78
30–34	28	27	22	27
35–39	14	17	13	14
40–44	9	9	8	8
45–49	7	8	7	6
50–54	5	5	5	5
55 and over	8	8	8	8
Total	431	402	437	435
Total marriages of men as percentage of marriages of women	110	115	108	109

46. It will be seen from Table 10 that the 1938 proportions married were even more "incompatible" than the 1938 marriage rates. The number of marriages resulting from the permanent maintenance of 1938 marriage proportions mainly reflects the proportions married at the higher ages. In these age groups the ratio of men to women in the population in 1938 was very different from what it would be in a stationary population. Most of the marriages of persons in these age groups in 1938 had, of course, been contracted many years earlier.

47. Table 10 also shows that both the 1942–47 marriage rates and 1947 proportions married were more "compatible" than the same indices in pre-war years. Nevertheless in a stationary population recent marriage rates and proportions married among men would still result in more marriages than would those of women. So far the closing of the "gap" has been achieved by a rise in the marriage rates of women. As was shown above, para. 41, it is unlikely that the closing of the gap could be achieved completely by an increase in the frequency of marriage among women. In any case if there are no "disturbances" of the sex-age structure of the population there can hardly be any general rise in the marriage frequency of men above the present level. Such a change would be arrested by a "shortage" of women.

48. Two qualifications to this conclusion must be discussed. In the first place it may be argued that even in the absence of war or migration the population may not be stationary. To make it possible for more men to marry in a generation than women requires an increasing population. We may approach the problem by answering the question "at what rate of increase would a stable population have to grow to make possible the permanent maintenance of such discrepancies between male and female nuptiality as those noted above?" This question can be answered precisely by comparing stable populations of different rates of growth in all of which the age distribution of brides marrying bridegrooms of given age is constant.(1) On this assumption

(1) In fact a changing rate of population growth would alter this distribution. Cf. J. Hajnal, "Some Comments on Mr. Karmel's paper on 'The Relations Between Male and Female Reproduction Rates'", *Population Studies*, Vol. II, No. 3, December, 1948. It would, of course, be equally possible to compare populations in which the age distribution of bridegrooms marrying brides of given ages was constant. The result would be the same (within the range of rates of increase which need be considered).

it is possible to show that even if the mean difference between the ages of bride and bridegrooms were about 3·5, i.e. greater than it is in England and Wales, it would take a stable population growing at a rate of more than 3 per cent. per annum to make it possible for over 9 per cent. more men to marry in each generation than women.(1) Such a rate of population growth may be regarded as out of the question for England and Wales in the foreseeable future.

49. Secondly it might be suggested that changes in mortality or the sex ratio at birth might make marriage rates compatible which with 1938–39 mortality and a 1938 sex ratio would not be compatible.

As regards the sex-ratio of birth, past changes have been comparatively slight. So far as mortality is concerned we may separate mortality below marriageable age from the mortality of later periods of life. The effect of variations in mortality at the younger ages on the ratio of male to female survivors in the life-table is slight. For the eighty-four life tables quoted in the *Statistical Year Book of the League of Nations*, 1942–44, the ratio of l_{15} for male mortality to l_{15} in the female life table is 0·99 or greater in only three cases and less than 0·97 in five cases.(2)

50. The effect of falling mortality at the marriageable ages is to increase the numbers in the stationary population in greater proportion at older ages. Thus if marriage rates remain constant the effect is to increase the number of marriages more in the male net nuptiality table than in the female net nuptiality tables, and the discrepancy discussed here is due to an excess of marriages in the male nuptiality table.

51. It may therefore be concluded that though the figure in Table 10 may not provide a precise measurement of the extent of adjustment required, there must occur in future (in the absence of war or migration) either a rise in female nuptiality or a fall in male nuptiality, or both.

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(1) See formula (32), para 163 below. A series of figures giving the differences between male and female nuptiality corresponding to various rates of increase and mean differences between the age of bride and bridegroom are to be found in Table 7 of P. H. Karmel, "The Relation between Male and Female Nuptiality in a Stable Population," *Population Studies*, Vol. I, No. 4, April, 1948.

(2) P. H. Karmel, "An Analysis of the Sources and Magnitudes of Inconsistencies between Male and Female Reproduction Rates in actual Populations", *Population Studies*, Vol. II, No. 2, 1948.

SECTION B.—BIRTHS

CHAPTER III—GENERAL FEATURES, COMPARISON OF THE TWO WAR PERIODS

The Available Statistics

52. The information at present available for the analysis of fertility movements in England and Wales between 1911 (when questions on fertility were asked at the Census) and 1938 (when the Population (Statistics) Act was passed) is extremely scanty. The only sub-division of births which the registration statistics provide prior to 1938, apart from sex, is that into legitimate and illegitimate births(1). Table 11 presents the development of the numbers of births from 1901 to the present day.

TABLE 11

Births(2) and Fertility Indices 1901–1947—Annual Averages

Period	All Births 000's	Legitimate Births 000's	Illegitimate Births 000's	Gross Reproduction rate	Illegitimate Births per 1,000 Unmarried Women 15-44	Legitimate Births per 1,000 Married Women 15-44	Legitimate Births related to weighted mean of Marriages (see text below)
1901–5 ..	938 7	901 6	37 0	—	8·4	230·6	3·983
1906–10	921 0	883·9	37·1	—	8·1	213·0	3·702
1911–15(2)	861·7	824 6	37·1	1 39	7·9	188·92	3·302
1916–20(2)	754·8	714 1	40 7	1·17	8 4	157·60	2·703
1921–23(2)	793 7	759·0	34·7	1 220	7·1	163·8	2·736
1924–26 ...	711 7	682·1	29·6	1·077	6 0	143·9	2·481
1927–29 ...	652 7	673 4	29 3	·970	5·9	129·5	2·266
1930–32 ..	631 6	603·4	28·3	·922	5·8	122·4	2·151
1933–35 ..	592 3	566·8	25·4	·850	5 5	111·7	1·972
1936–38 ...	612 4	586 8	25·5	·877	5·4	110·4	1·938
1939–41 ...	594·6	567·1	27·4	·859	6 3	100·0	1·716
1942–44 .	695 8	650·7	45·1	1 002	10·9	109·6	1·936
1945–47(3)	795·9	741·4	54·4	1·161	14 2	124·3	2·247

(1) Since 1927 stillbirths have been registered in England and Wales, but they do not concern us here.

(2) Birth statistics for England and Wales in the years up to 1938 relate to the numbers of births registered each year and not to the number actually occurring. There may be a difference between the registrations and occurrences in a year, since the law permits the registration of a birth to be deferred until 42 days after its occurrence. But the difference is not likely to be great in normal circumstances. Since 1939 the statistics record the number of births occurring in each year.

The figures given in the above table for the years 1914–1922 are based on the birth data in the *Registrar General's Statistical Review of England and Wales*, 1938–1939, Text p. 235. As is explained in the *Statistical Review*, loc. cit., " for these years the actual occurrences were not adequately reflected by the numbers registered owing to changes in registration time lag associated with successive food rationing and de-rationing procedures and to abnormal changes in the numbers of births themselves; the numbers registered have therefore been adjusted in the light of information bearing on the changes to correspond with the true occurrences ". All figures in the present report relating to births or fertility in 1914–22 have been based on these adjusted data.

(3) Figures for 1947, included here, are provisional.

53. Table 11 also gives some simple indices based on the birth figures. In the first place it is possible to relate births to the population of women of childbearing age. By a process of indirect standardization allowance can also be made for variations in the age structure of the female population of childbearing age. This object is achieved by the gross reproduction rates shown in Table 13 which for years before 1938 have been computed by means of substitute fertility rates(1). (For years after 1938 the gross reproduction rates have been computed by the usual method from the known distribution of births by age of mother.) Secondly account may be taken of changes in the proportion of women of childbearing age who are married. For this purpose illegitimate births have been related to the number of unmarried women aged between 15 and 45 and the number of legitimate births to the number of married women under 45 years of age. Finally, as has been seen in Chapter I, the number of marriages has fluctuated irregularly in the period considered and it has therefore seemed desirable to take account of changes in the distribution of the population of married women by duration of marriage. This also can be done roughly on the principle of indirect standardization, by relating the legitimate births of each year to a weighted mean(2) of the marriages of previous years. An index so computed is given in the last column of Table 11. This index will be referred to as the " productivity of marriage ". The weights are proportional to the number of births which the marriages of previous years could be expected to produce in the year under consideration.

The Development of Fertility Rates up to 1939

54. The number of births in England and Wales had by the 1930's fallen from an annual average of almost 940,000 in the early years of the century to under 600,000. This decline was proportionately far smaller than the decline in the frequency of births to women of childbearing age or to marriages, as the final columns of Table 11 show. Since 1900 the number of women of childbearing age has increased greatly.

55. It will be seen that with the exception of the post-war years 1921–23, all the fertility indices decline steeply and continuously up to the period 1933–35. Thereafter there is no very clear tendency until in the years after 1942 all the fertility indices rise steeply. The parallel between the recent high

(1) The gross reproduction rates for 1938 and earlier years have been taken from the *Registrar General's Statistical Review of England and Wales*, 1938–39, Text p. 207 where the method of computation is fully set out. It should be noted that the gross reproduction rate is here used solely as a convenient index which is standardized to allow for variations in the age distribution of the female population. The special features of the gross reproduction rate which give it its traditional importance (for example that it is based on female births only, provides an upper limit to the net reproduction rate and so forth) are not relevant. The gross reproduction rate can hardly be regarded as a reproduction rate in the sense in which that term is used in Section C below.

(2) The calculation of weights was based on the distribution of the births of 1939 by duration of the parents' marriage. In order also to allow for the fact that the proportion of first marriages has been changing, the legitimate births have been related to the weighted mean not of all marriages but of marriages of spinsters under 45. The exclusion of widows' and divorcees' marriages is particularly important for recent years, when, largely owing to the effects of war, the proportion of such marriages to all marriages has increased sharply. If widows' marriages were included in the calculation, the effect would be to give the impression of a decline in the number of births per marriage, even if everyone who married once or more continued to have the same number of children as before. Details of the computation are set out in *Note IV*. The process of relating legitimate births to the weighted averages of the marriages of previous years seems to have been used first by C. Gini See, for example, his paper: " Di un procedimento per la determinazione del numero medio dei figli leggitimi per matrimonio ", *Metron*, Vol. X. No. 1–2, 1932, p. 3

birth figures and the events after the last war will be discussed below. An important preliminary problem which arises is to determine what could have been expected to happen had there been no war. In the case of 1914–18 the answer is clear. All indices of fertility were falling in the years previous to the war and had been falling since the 1870's. It is obvious that the phenomena of 1914–18 constituted a temporary disturbance in a continuous downward trend.

56. But what does the movement of fertility indices in the years before 1939 suggest as the natural development? Unfortunately the answer is by no means clear. The lowest point of the pre-war period as regards the number of births and the gross reproduction rate was reached in 1933(1). Fertility indices other than the gross reproduction rate did not reach their lowest point in 1933 though even in their case 1933 seems to mark a sharp change in the rate of decline. To obtain a reasonably clear idea of the rate of decline in the fertility indices at various periods, it is necessary to smooth the fluctuations shown by the values for individual years. Various methods of smoothing yield substantially similar results. The three-year grouping adopted in Table 11 seems suitable. For the present purpose it is convenient to express each index of fertility as a percentage of that recorded in the previous three-year period. This is done in Table 12.

TABLE 12

Fertility Indices, 1924–1947

Each figure expressed as Ratio (per cent.) of that for preceding Period

Period	Gross Reproduction Rate	Illegitimate Births per 1,000 Unmarried Women 15–44	Legitimate Births per 1,000 Married Women 15–44	Legitimate Births Related to weighted mean of Marriages of spinsters under 45
1924–26 .	88·3	84 5	87·9	90·7
1927–29 ...	90·1	98·3	90·0	91·3
1930–32 ...	95·1	98·3	94·5	94·9
1933–35 ...	92·2	94·8	91·3	91·7
1936–38 ...	103·2	98·2	98·8	98·3
1939–41 ...	97·9	116·7	90 6	88·5
1942–44 ...	116·6	173·0	109·6	112·8
1945–47 ..	115 8	130 3	113·4	116·1

57. As the first three lines of the table show, all the fertility indices declined rapidly from the high post-war levels of 1921–23 but the rate of decline was steadily diminishing. Fertility indices again fell sharply from the level of 1930–32 probably owing to the economic depression. During the recovery from the depression, the gross reproduction rate increased while the indices of legitimate and illegitimate fertility taken separately declined. The increase

(1) The significance of this fact is not altogether certain. As was mentioned in footnote (2) to Table 11, the statistics are based on the births registered in each year. It has been argued that perhaps more births actually occurred in 1933 than in 1934 (see R. R. Kuczynski, "Demography, Science and Administration" *Eugenics Review*, April, 1945). It is, however, likely that the minimum was actually reached in 1933 since this date fits in with the economic development of the period. A minimum in 1933 was also observed in several other demographically similar countries (Denmark, Germany, South Africa, Sweden, U.S.A.). It has been plausibly suggested that the fact that the minimum point was delayed for some years in other countries of low fertility may be connected with their different economic development. This applies notably to the "gold bloc" countries—Holland, Belgium, France, Switzerland (See A. Sauvy, "La Reprise de la Natalité dans le Monde", *Population*, April–June, 1948, p. 254.)

in the gross reproduction rate was thus solely due to increases in the proportion of women married. The course of the " productivity of marriage " shows that the increase in legitimate births was due solely to the growth in the number of marriages.

58. The decreases in legitimate fertility rates, however measured(1), in the period 1933–38 were slight. The rate of decline was much smaller than in the previous period of economic recovery in 1927–29; it was smaller in fact than in any previous period—excepting the post-war years—since 1880. It could therefore be argued that the fact that in the years 1933–39 the previous precipitous decline in fertility rates had been checked, suggested that the decline might soon end completely and might even be succeeded by a rise. On the other hand it could be suggested for reasons which are sociological rather than statistical that the low rate of decline in these years was connected with, and compensated for, the abnormally sudden decrease in the previous depression years. There were also other non-statistical reasons which supported the belief that a more rapid decline in fertility rates would be resumed. In particular, many demographers believed that a " small family pattern " would continue to spread to those sections of the population whose fertility had remained high.

Legitimate and Illegitimate Fertility

59. Some guidance for the examination of the birth statistics of the years since 1939, for which the data collected under the Population (Statistics) Act of 1938 supply more detailed information, may also be obtained from Table 12. As would be expected on the basis of Section A, the development in the number of marriages and proportions married exercised an important influence on the course of fertility rates. During the years after 1939 the gross reproduction rate shows at first a very slight decline and then rises rapidly to an average of over 30 per cent. above pre-war levels in 1945–47. The two indices of legitimate fertility show a much steeper fall in the period 1939–41, and a far gentler rise thereafter. The divergence between the gross reproduction rate and these indices is due in the main to two factors; the effect of marriage and the sharp rise in the rates of illegitimate fertility during the war.

The rise in illegitimacy is generally agreed to be a temporary phenomenon due to the special circumstances of war time. It has some bearing on the interpretation of legitimate fertility rates, but this effect must be taken account of separately.

Legitimate Fertility in the two Wars

60. The main task in analyzing recent fertility statistics is thus the interpretation of the rise in legitimate fertility rates. As a first step, it is instructive to compare developments in the 1939–45 war with what happened in the period during and after the war of 1914–18. The ratio of births in each year to the weighted mean of marriages of previous years is shown for the two war periods in Table 13.

61. There is some superficial resemblance between developments in the two wars. In both there was some decline in fertility after the outbreak of war, and in both there was a steep rise in fertility rates to a peak about two years from the end of the war(2). It is, however, clear from Table 12 that the resemblance between the fertility history of the two wars is merely superficial.

(1) For a discussion of some other indices, see *The Registrar General's Statistical Review of England and Wales*, 1938–39, Text pp. 189–90 and 192.

(2) Examination of the birth statistics by quarters show that the peak (the highest number of births in a quarter) of the post-war boom after the war of 1914–18 was reached in January–March, 1920, and after the 1939–45 war the peak was reached in the quarter April–June, 1947.

TABLE 13

"Births per Marriage" in the two Wars

First War			Second War		
Year	Births per marriage	Indices 1911–13=100	Year	Births per marriage	Indices 1936–38=100
1911–13 ...	3·413	100	1936–38 .	1·938	100
1914 ..	3·322	97	1939 .	1·861	96
1915 .	2 950	86	1940 .	1·694	87
1916 ...	2·802	82	1941 ...	1·594	82
1917 ..	2 393	70	1942	1·791	92
1918 ...	2·334	68	1943 .	1·894	98
1919 ..	2 624	77	1944 .	2·124	110
1920 .	3·362	99	1945 ...	1·893	98
1921 ...	2·910	85	1946 ...	2·320	120
1922 ..	2·669	78	1947 ..	2 528	130
1923 ...	2·630	77			

In the first place the scale of the movement in the case of the war of 1939–45 was entirely different. In the year in which fertility was highest after 1914–18, in 1920, the number of births per marriage hardly surpassed the level of the lowest pre-war year. By contrast, the number of births per marriage has been above the level of 1939 in every year since 1943. In 1947 it reached a level not attained for more than 20 years, and the mean of the years 1944–47 was over 15 per cent. above the pre-war (1936–38) level. Secondly, the time at which the rise in fertility took place in the case of the recent war show that the movement was different in character from that of 1914–18. For fertility rates began to rise after 1941, long before the end of the war. This movement cannot have been due to the return of husbands who had been separated from their wives. At the time when the births of 1942–44 were conceived, more married men were outside the country than in 1940 and 1941(1).

62. There is a further reason for attributing special importance to the recent rise in fertility rates. A similarly startling rise has been experienced in many foreign countries where fertility rates had previously been falling as in England and Wales. Indeed, an increase in legitimate fertility rates may be said to be universal in all the countries which had previously had the lowest fertility. It is shared equally by neutrals and belligerents.

CHAPTER IV—FAMILY SIZE AND THE POSTPONEMENT OF BIRTHS

63. The interpretation of recent increases in legitimate fertility rates clearly involves a question of crucial importance for assessing the prospects of population growth in England and Wales. Judgment about the future of fertility depends on the interpretation of what has been happening in the recent past. A full interpretation involves a multitude of sociological considerations which cannot be discussed in this report. It is, however, the duty of the statistician to present an analysis of the figures which may be helpful for an assessment of the social forces at work. To this extent, at any rate, statistical analysis must be coloured by a view of what the explanation of fertility changes might be. In the present instance there is one type of statistical analysis which is especially relevant to the interpretation of the increase in fertility rates.

(1) The fall in fertility rates between 1944 and 1945 does, however, seem to have been due to the departure of members of the Forces for the invasion of Europe after "D Day", 1944, and the recent peak in fertility rates is connected with the return of members of the Forces and their demobilisation after the war.

64. It seems obvious that one of the most important factors determining the decisions of married couples in regard to the children they will have at a given time is the number of children which they have already had. If for any reason they have tended to have abnormally few children in the past, they may make up for that deficiency by a rate of childbearing which is above normal. On this theory the fertility rates of any one year should not be analyzed in isolation from those of previous years, for a rise in fertility rates may correspond to a previous fall and thus have the effect not of increasing the number of children which married couples have above that which their predecessors had, but simply of making up for the previous low rate of child-bearing and of bringing their total number of children closer to that of their predecessors. It may be therefore that a rise in fertility rates may not be an indication of any " trend " towards the maintenance in the long run of higher fertility rates but it may, in whole or in part, result from the fact that " postponed " births are being " made up "(1). On the " postponement " theory attention must evidently be devoted to studying the total number of births which occur to a cohort of marriages throughout their existence. This will be referred to as the " size of family " of a cohort of marriages, in contrast to legitimate fertility rates which show the rate at which married couples were adding to their families in a given period.

Evidence for the Postponement Theory

65. The present discussion must be limited to presenting, so far as the available statistics permit, material which may help to show whether there is an element of truth in this theory, as applied to the history of births during the war period in England and Wales. Table 14 shows fertility rates specific by duration of marriage for the years 1939–46.

66. Table 14 shows that the fertility rates of the first year of marriage fell most steeply in 1939–41 and have not recovered to the pre-war level. This is mainly a reflection of a fall in the proportion of marriages in which the bride was pregnant at marriage.

67. It will be seen that the pattern of fertility has not remained the same during the recent striking increase in fertility rates. Fertility rates have increased far more strikingly at high durations of marriage than at low durations. This is in accordance with the " postponement " theory. It suggests that it was the persons who in the early years of the war had had fewer children than they would normally have had, who " made up " for this deficiency in the years 1942–46. It should be remembered that fertility rates decrease with increasing durations of marriage. A given number of children ' postponed ' at, say, marriage duration ' 2 ' therefore represents a smaller percentage of the 1939 fertility rate at that duration, than of the fertility rate at duration ' 6 ' when the ' postponed ' fertility was " made up ". In other words a drop in a low-duration fertility rate in 1940 may be followed by a far larger proportionate rise in the fertility rate at a correspondingly higher duration in subsequent years. This feature of the recent rise of fertility rates—namely, that the rates for marriages of long duration have increased more than those for marriages of short duration—is shared by a number of foreign countries for which figures are available.

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(1) For a more general discussion of the issues involved in the " postponement theory " as applied to recent movements of fertility, see J. Hajnal, " The Analysis of Birth Statistics in the Light of the Recent International Recovery of the Birth Rate ", *Population Studies*, Vol. I, No. 2, September, 1947.

TABLE 14(1)

ɩ) Legitimate Maternity Rates by Marriage Duration per 1,000 Married Women under 45

Year	Marriage Duration 0	1	2	3	4	5	6	7	8	9	10 and over
938 ...	271	251	204	177	159*	140	121				
939 ...	252	240	199	174	154	136	119	105	93	83	44
940 ...	201	228	181	161	140	120	105	93	82	75	42
941 ..	188	215	168	139	125	110	96	85	77	70	42
942 ...	191	220	193	169	145	133	118	100	87	79	45
943 ...	212	235	179	170	154	138	128	114	98	86	47
944 ...	240	259	193	169	166	155	137	130	116	102	56
945 ..	214	255	178	155	136	134	123	109	100	92	51
946 ...	238	284	217	193	193	180	179	152	128	115	57

(b) Indices of Legitimate Maternity Rates by Marriage Duration (1939 = 100)

938 ..	107·3	104·6	102 7	101·5	102·7	102·7	101 5				
939 ...	100 0	100·0	100·0	100·0	100 0	100·0	100·0	100·0	100·0	100·0	100·0
940 ...	79 8	95·2	90·8	92·4	90·9	88 6	88·0	88·7	88·8	90·2	93·8
941 ...	74·6	89·9	84 7	79·6	80 8	81·3	80·3	81·3	83·3	83·9	95·8
942 ..	75·7	91·6	97·1	96 9	94·0	97·9	99 0	95·7	94·0	95 4	101·5
943 ...	84·6	98·2	90·0	97·8	99·7	101·5	107·3	109·4	105·8	103·6	107·0
944 ...	95·2	107·9	97 0	97·1	107·8	114·0	115·1	123·8	124·7	122·9	127·3
945 ...	84·9	106·3	89·4	89·1	88·3	98·5	103·4	103·8	107·5	110·8	115·9
946 ...	94·4	118·3	109·0	110 9	125·3	132·4	150·4	144·8	137·6	138·6	129·5

68. Figures for Germany, Sweden, and Queensland (Australia) are quoted elow in Table 15 in index form. For Sweden(2) and Queensland, Table 15 ompares the rates in the last three years for which data are available with he pre-war level. For Germany Table 15 gives rates for 1937–39 which have een related to the rates of 1933. The rise in fertility rates after 1933 in Germany displays some similarity with that which has occurred in other ountries at a more recent date.

(1) The figures in Tables 14 and 16–18 are in terms of "maternities" and not births. The category "maternities" differs from "births" in that (a) births as used throughout this report are equivalent to "live births", and so exclude stillbirths, which are included in maternities, (b) multiple births, which may result in two or more live births, are counted as one maternity.

The duration of marriage in Tables 14–16 is to be understood as follows: marriage duration '0' refers to marriages which have not completed their first year, marriage duration '1' to marriages which have lasted more than one, but less than two years, and so forth. In Tables 17–18, which have been computed by a process of summation described below, the figures relate to the position at the end of the stated number of years of marriage.

(2) The Swedish data are of the type published in an article by Professor C. E Quensel, "Population Movements in Sweden in Recent Years", *Population Studies*, Vol. I, No. 1, June 1947, p. 41. Professor Quensel has kindly supplied figures for 1944. The Queensland rates are of the type published in C. Clark and E. Dyne "Applications and Extensions of the Karmel formula for Reproductivity", *Economic Record*, July 1946, p. 30. The rates for 1945 and 1946 were kindly supplied by Mr. Colin Clark.

TABLE 15

Indices of Fertility Rates specific by Duration of Marriage—Various Countries

Duration of Marriage (years)(1)	Germany (1933=100)			Sweden(2) (1936–40=100)			Queensland (1939=100)		
	1937	1938	1939	1942	1943	1944	1944	1945	1946
0	108	109	95	104	110	116	52	57	61
1	107	109	109	107	119	124	88	87	93
2	112	118	120	120	116	126	88	92	92
3	119	125	131	116	133	126	94	105	102
4	127	129	135	126	128	140	108	114	115
5	135	139	140	123	130	132	109	109	116
6	137	144	149	126	134	140	94	103	104
7	137	147	155	121	140	141	101	112	102
8	138	150	161	123	135	142	100	109	107
9	141	151	161	117	122	131	102	115	107
10	151	162	173	117	135	135	107	114	114
11	153	162	172	127	136	136	129	121	129
12	148	161	169	124	143	135	127	140	121
13	150	161	174	122	131	127	139	123	139
14	136	153	162	98	116	117	133	117	119

69. The fact that the fertility of marriages of long duration has increased more than that of marriages of short duration is, however, not as conclusive as might appear at first sight. It may be objected that the same result would appear if what had happened was that persons who would under earlier conditions have stopped having children when they had had two went on to have a third, persons who would have stopped at three went on to four and so on. It is obvious that such a change would increase the fertility rates more at those durations of marriage where second and third and higher order births mainly occur, rather than the fertility rates relating to very recent marriages most of whose children are first born children.

70 The fertility rates given in Table 14 may be split into the components due to births of each order. The resulting figures are given in Table 16.

71. Table 16 shows that the change in the distribution of fertility between marriages of various durations is not the result of additions due to births of higher order to the fertility rates of marriages of long duration. Fertility rates for *each* order of births have increased proportionately more at higher than at lower durations of marriage. The phenomenon is particularly striking in the case of first births. Marriages which have lasted six years or more have in recent years been having first maternities at more than twice the rate recorded before the war. The statistics thus suggest that a strong element of "postponed" births is included in the high birth figures of recent years.

(1) For Germany and Queensland, each rate given relates to the births of marriages occurring within one calendar year, and the duration of marriage is defined as the difference between the calendar year of marriage and the calendar year of birth. The definition of duration for the Swedish rates is the same as in England and Wales.

(2) The figures relate only to marriages in which the wife was aged 20–24 at marriage.

Does "Postponement" account for the Whole Rise in Legitimate Fertility Rates?

72. The important question which arises from this analysis is whether the postponement theory can account for the whole rise in legitimate fertility rates. In statistical terms the question is whether recent cohorts of marriages have had throughout the whole course of their existence more children than the preceding cohorts of marriages had had when they had lasted for the same length of time. This question cannot be answered properly because the tabulation of births by duration of marriage is available only for the period July 1938 onwards. We are enabled to follow the fertility history of one cohort of marriages, those occurring about 1938, during their first eight years of marriage, and of more recent cohorts of marriages for shorter periods of time. We have, however, no standard of comparison with the pre-war period and cannot decide whether, say, the number of births which the marriages of 1939 have had in their first seven years of marriage is greater than that which the marriages of 1930 had had in a similar period. Some effort may, however, be made to reconstruct the history of family size for a few years before the war. As Table 11 shows, legitimate fertility rates in the years 1932–37 must have been of about the same general level as the fertility rates of 1938. The decline in these years was gentle. We may therefore suppose that during these years the pattern of fertility between various durations of marriages was not very different from what it was in 1938. Accordingly the following procedure was adopted.

73. The fertility rates of married women under 45 at each duration of marriage in 1938 were multiplied by the ratio which the number of births per marriage for a year bore to its value in 1938. This was done for each year from 1932 to 1937. From this set of fertility rates the total number of children born to various cohorts of marriages was obtained by adding the fertility rate of '0' duration for one year to that of duration '1' in the next year, duration '2' in the year after and so forth. For example, consider the generation of women who in 1941 were at marriage duration '0'. As Table 14 shows, there were 188 maternities for every 1,000 women. At marriage duration '1' in 1942 what was substantially the same group of women had 220 maternities. Consequently, the mean number of children after the second year of marriage in this group of women was $\cdot 188 + \cdot 220 = \cdot 408$. The resulting figures are presented in Table 17(1).

(1) More precisely, the figures in Tables 17 and 18 represent the size of family of marriages still existing at the end of the duration stated and in which the wife is still under 45. The computation of the size of family of marriages still in existence by adding the fertility rates, is reminiscent of the conception of the gross reproduction rate as the number of children born to women who survive to their 50th birthday. This method of computation assumes that at each stage the fertility rates of those who are withdrawn from the experience (by death, etc.) is the same as that of those to whom the sum of the rates is supposed to apply. The distortion introduced by this erroneous assumption is negligible for short durations of marriage. Moreover the essential comparisons, i.e. those between the family size of successive cohorts after *the same* duration of marriage, are only affected in so far as the distortion differs between different cohorts of marriages. If a calculation of this type is restricted to marriages of wives of given age (as is possible, for example, in Sweden) the possibility of distortion is, of course, greatly reduced.

However, even if the basic rates were accurate and the difficulty just referred to did not arise, the results of such a calculation would not necessarily be strictly accurate. This is because the rates which are added together do not cover all the maternities, but only the maternities to a given cohort. Consider for example a woman married in July 1934 who had a maternity in March 1940 (i.e at marriage duration "5") and another in September 1941 (i.e. at marriage duration "7"). In the process of computation resulting in Table 17, the maternity of 1941 would be allocated to a different group of women from that to which the maternity of 1940 is allocated. The effect of such cases would be largely compensatory.

TABLE 17

Total Number of Maternities up to various Durations, by Cohorts of Marriages

Completed Years of Marriage	Year of "0" Duration																
	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948
1	0·291	0·274	0·279	0 275	0 273	0·270	0·271	0·252	0 201	0 188	0 191	0 212	0·240	0·214	(0 238)	(0 259)	(0·259)
2	0 546	0·533	0·534	0·527	0·523	0·521	0·510	0·480	0·416	0·408	0 426	0·471	0·495	0 498	(0 547)	(0 568)	—
3	0·756	0·740	0 740	0 731	0·727	0·720	0 691	0·649	0·609	0·586	0·619	0 648	0·713	(0 735)	(0 748)	—	—
4	0 936	0 918	0·916	0·908	0·902	0·881	0·829	0 817	0·780	0·755	0·773	0 842	(0·923)	(0·945)	—	—	—
5	1 095	1 077	1 075	1 062	1·042	1·006	0·974	0 971	0 946	0 892	0 966	(1·052)	(1·134)	—	—	—	—
6	1·235	1 216	1·210	1·183	1·152	1·139	1·112	1·126	1·080	1 071	(1·162)	(1·248)	—	—	—	—	—
7	1·356	1 335	1·315	1·278	1·270	1·266	1·249	1·249	1·259	(1·266)	(1·357)	—	—	—	—	—	—
8	1·460	1·428	1 400	1·378	1·384	1·396	1·358	1 401	(1·425)	(1·432)	—	—	—	—	—	—	—
9	1·543	1·505	1·487	1 476	1·500	1·496	1·486	(1·540)	(1·564)	—	—	—	—	—	—	—	—
10	1·612	1·586	1·573	1·579	1·592	1·611	(1·611)	(1·666)	—	—	—	—	—	—	—	—	—

74. So far the tabulation of births by duration of marriage is available only up to 1946. But the fertility rates of 1947 were even higher than those of 1946 and it is already clear that fertility rates in 1948 will be far above any "normal" level. An attempt has therefore been made to allow for the effect of the births of 1947 and for those of 1948 on the total family size. This was done by estimating for 1947 a series of fertility rates by the same method as that used for 1932–37 except that the basic fertility rate of each duration of marriage was that of 1946. It was further assumed that the fertility rates of 1948 would be the same as those of 1947. So far as indications available at the time of writing go, fertility rates in 1948 will be distinctly below those of 1947 (on the other hand fertility rates in 1949 may still be above the normal level which would correspond to the maintenance of pre-war family size). On this basis the last two figures in each column of Table 17 have been added, showing the position of each cohort of marriages at the end of 1947 and 1948.

75. Each line of Table 17 shows the achievement at the same durations of marriage of successive cohorts of marriages. Reading from left to right we find that the total number of children shown in the table first decreases and then rises. The increase is hardly noticeable by the end of 1946, the last point for which fairly reliable figures are available. Both the decline and the subsequent rise are most pronounced in the upper lines of the table, i.e. for marriages of short duration. The fall and subsequent rise are the consequence of the postponement and making up of births.

76. The important question which must be asked about the movement as a whole is: How does the position at the end of the making up process compare with the position before the disturbances began? Some figures from Table 17 have been reassembled with this aim in view in Table 18. In Table 17 each column shows the achievement of a group of marriages occurring at the same time at various subsequent dates; in Table 18 on the other hand each column shows the achievement at the same date of marriages occurring at various periods. It must be recalled that many of the figures are highly speculative; all the figures in the column relating to the position in 1939 contain an arbitrary element except for the first two, and all the figures for 1947 are speculative.

TABLE 18

Total Number of Maternities occurring to Marriages of different Durations by the end of 1939, 1946 and 1947

Completed years of marriage	1939	1946	1947	Cohort of marriages experiencing 1938 rates
1	0·252	0·238	0·259	0·271
2	0 510	0 498	0 547	0·522
3	0·720	0·713	0 735	0 726
4	0 902	0·842	0 923	0·903
5	1 062	0·966	1·052	1·062
6	1·210	1 071	1·162	1·202
7	1·335	1·259	1·266	1·323
8	1·460	1·401	1·425	1·430
9	—	1 486	1·540	1·525
10	—	1·611	1·611	1 609

77. Table 18 shows that at the end of 1946 marriages of all durations of less than nine years had produced fewer children than marriages which had lasted the same length of time at the end of 1939. The figures for 1947 are

above those for 1939 at short durations of marriage, but it is precisely at these durations that the unknown element in the figures, namely, that part of the fertility experience of the marriages concerned which occurred in 1947, has the greatest effect on the figures. It is clear that if fertility rates for 1948 are at anything like the 1947 level the marriages of some generations at least will by the end of 1948 have had more children than marriages of the same duration had had at the outbreak of war.

78. Since the 1939 figures given in Table 18 are to some extent speculative, another column has been added showing what would be the size of family achieved at various dates after marriage by a cohort exposed throughout its existence to the rates recorded in 1938. It will be seen that at marriage durations over six years some part of the excess of the second column of the table over the third is due to the fact that the cohorts concerned had in earlier years had children at higher rates than those of 1938. Though the estimates of family size are speculative it is possible indirectly to check that the total number of legitimate births occurring in the years 1939–47 would not have occurred in a population in which no cohort of marriages had more children than the number corresponding to 1938 rates. If we apply the 1938 legitimate fertility rates to the population of married women in the war years and add the resulting expected births for the whole period, the calculation shows that the total number of legitimate births in the years 1939–47 exceeded that which would have been obtained had 1938 rates been in operation throughout the period.

79. A convenient and very simple calculation which shows this point is that illustrated in Table 19 below. If we compute the number of legitimate births which would have occurred if in each year from 1939 to 1947 the "productivity of marriages" had been at the 1938 level, we find that the total falls short by 94,000, or 1·6 per cent., of the total number of legitimate births in

TABLE 19

"Expected" and Actual Legitimate Births in the two Wars

Year	Mean of marriages of spinsters under 45 in previous years (000's)	Assumed "normal" number of births per marriage	"Expected" Legitimate births (000's)	Actual Legitimate births (000's)	Deficit (−) or excess (+) of actual when compared with expected	Cumulative total of previous column
1938..	307·6	1·933	595	595	—	—
1939...	316·5	1·933	612	589	− 23	− 23
1940..	333·2	1·933	644	564	− 80	−103
1941..	343·9	1·933	665	548	−117	−220
1942 ..	343·4	1·933	664	615	− 49	−269
1943 .	338·3	1·933	654	641	− 13	−282
1944..	327 8	1 933	634	696	+ 62	−220
1945...	325·6	1·933	629	617	− 12	−232
1946 ..	330·6	1·933	639	767	+128	−104
1947...	332·6	1·933	643	(841)	+198	+ 94
1914...	251·9	3·322	837	837	—	—
1915 ..	258·7	3 240	838	763	− 75	− 75
1916 ..	265·4	3·159	838	744	− 94	−169
1917..	261·1	3·077	803	625	−178	−347
1918..	257·7	2·995	772	602	−170	−517
1919...	261·6	2·914	762	687	− 75	−592
1920..	271 8	2·832	770	914	+144	−448
1921...	278·1	2·751	765	809	+ 44	−404
1922...	277·7	2·669	741	741	—	−404

1939–47. No precise significance should be attached to this figure, for other equally legitimate or more refined methods of calculation would give slightly different results(1).

80. It should be noted that this type of calculation does not prove that family size has been increasing. It would have been possible for fertility rates to fall to the 1938 level and then to rise permanently above it, while no cohort of marriages had throughout its existence more children than its predecessors had had.

81. However, even if it is not quite clear that there has been an increase in family size in the statistical sense, it is necessary to remember that in a full appraisal of the situation certain non-statistical factors must be taken into account. If there were no change in the family building behaviour of the population, one would have expected the making up of postponed births to be far less complete than it has been. One would have expected that as a result of war-time circumstances, such as the separation of husbands from their wives, there would still have been a substantial number of postponed births left to be made up at the end of 1947, only two and a half years after the end of the war, when demobilisation could not yet have exerted its full effect on births. Finally it may be recalled that there is at present no information on many important aspects of recent fertility movements. Not even guesses can be made about the way in which the family size of various sections of the population has been changing, or how the postponement and making up of births has been distributed between different groups. The interpretation of recent fertility movements cannot be seriously attempted until such information is available.

The " true " Level of Fertility Rates at the present Time

82. To obtain a significant idea of future prospects of population growth by means of projections or the calculation of reproduction rates, one must attempt to answer the question: What is the " true " level of fertility rates at the present time, i.e., what would fertility rates be at present if they were not " artificially " increased by the making up of postponed births? When phrased in this way the question is rather vague. Attempts at greater precision really involve sociological judgments. Here only some rough calculations, such as are made possible by the statistical material available, are attempted to illustrate the general order of magnitude of the " true " fertility rates taken over the whole period 1939–47.

83. It is clear from the type of calculation discussed above (in para. 79) that the " true " level of fertility rates in the war years considered as a whole must be above the 1938 level. To suppose that the " true " level was at or near the 1938 level would imply that it was reasonable to expect all the " postponed " births to be " made up " by the end of 1947. This, as mentioned above, is not a reasonable assumption. In fact some of the recent rise in legitimate fertility rates is due to factors other than postponement and, therefore, in the present meaning of the term represents a " true " increase in fertility rates. An idea of the scale of this effect may be obtained by comparing the fertility movements occurring in the period 1939–47 with those that accompanied the 1914–18 war. The calculation is set out in Table 19.

84. The top part of Table 19 compares year by year the number of legitimate births which occurred in 1939–47 with that which would have been expected

(1) Significantly different results would be obtained if the calculation were carried out separately for marriages of women of different ages. Since the increase in the number of marriages of young women was particularly sharp and the fertility rates of such marriages were far above the average this procedure would considerably raise the number of births which could be " expected " if 1938 rates had been in operation throughout. But for reasons discussed in Chapter VII, paras. 228–9 below, the assumption implied in such a calculation is not reasonable.

had the number of births per marriage been at the 1938 figure. The growth of the "deficit" of births due to postponement and the subsequent "making up" is thus traced. As already mentioned in the final balance there were 94,000 more births in 1939–47 than there would have been had the number of births per marriage been constant after 1938. The lower part of Table 19 carries out an analogous computation for the war of 1914–18. Before the war the number of births per marriage was dropping rapidly and the position at which this index settled down after the disturbances created by the war had ended was well below the level of 1914. For this reason the expected births have been calculated by assuming that at each year between 1914 and 1922 fertility rates diminished by a constant amount, the number of births per marriage in 1914 and 1922 being taken at the levels actually recorded. It will be seen that the total deficit in the years 1915–19 was far greater than that in 1939–42. It amounted at the end of 1919 to 592,000 births. Excesses recorded during 1920–21 amounted altogether to 188,000 births, i.e. it may be said that roughly 30 per cent. of the 'postponed' births had been made up. If we suppose that in the second war a similar percentage of the births postponed up to the end of 1943 had been made up, the total number of births due to the making up of postponement would amount to only 89,000. Since in fact the excess in the years 1944–47 was 376,000 births, we may say that throughout the period 1939–47 there were 290,000 more births than would have occurred if fertility had been at 1938 level throughout, and the making up of postponement had taken place to the same extent as in the last war. These 290,000 births represent 5·0 per cent. of the total number expected at 1938 legitimate fertility.

85. It is probable, however, that a far greater proportion of the deficit in births was made up in the case of the 1939–45 war than in the 1914–18 war. Casualties were fewer in the recent war and correspondingly the number of marriages dissolved was smaller(1). Also there is every reason to believe that deliberate planning of the number and timing of births has had a far greater effect in the 1939–45 war. So far as this point is concerned, 5·0 per cent. might be considered as a maximum estimate of the extent by which the "true" legitimate fertility of recent years exceeds that of 1938. On the other hand no allowance has so far been made for the anticipated high total of births in 1948, or for the fact that owing to the very high rates of illegitimacy in the later war years, a greater proportion of the women married in recent years began their married life with one child than formerly. Allowance for these and other possible factors could hardly raise the upper limit by more than another 5(2) per cent. to 10 per cent. above the 1938 figure.

86. Finally all the years 1939–47 have been treated as a unit. But if there is some sort of underlying rising "trend", then the average "true" fertility rates of all these years may be considerably below the "true" level of say 1945–47. The possibility cannot therefore be ruled out that, in a significant sense, the "true" level of legitimate fertility as it would be but for the effect of postponed births, is by now more than 10 per cent. above the 1938 level.

(1) The fact that the dissolution of marriage prevents the making up of postponed births is not relevant to the consideration of Tables 17 and 18 above, for these tables are in terms of the total birth achievement of marriages still *in existence*. The point does become relevant as soon as we deal with "expected" births calculated on the basis of the number of marriages *contracted*.

(2) As the above calculation shows, such an allowance amounts roughly to the assumption that the gap between the births occurring and the births "expected" at 1938 rates was really greater by another 290,000. The difference between actual and expected births in 1947 was 198,000 and a similar allowance for 1948 can probably be treated as a maximum. 90,000 is a very ample allowance for the possible effects of an increase in illegitimate births and other factors.

SECTION C—THE MEASUREMENT OF REPRODUCTIVITY

CHAPTER V—THE SIGNIFICANCE OF REPRODUCTION RATES

The Conventional Net Reproduction Rate (N.R.R.)

87. Recent trends in the frequency of marriages and births have now been described. It is desirable to sum up the implications of these frequencies for future population growth. The question: "What will be the rate of growth of the population in the long run if given rates of marriages and births are maintained ?" can be answered quickly by the device of computing a "reproduction rate". The term reproduction rate as here used includes the conventional net reproduction rate (which will always be referred to as the N.R.R.) as well as other computations of the same type. The meaning of the term in this wider sense will become clearer below.

88. The point of departure of the present discussion is a treatment of the inadequacies of the familiar N.R.R. This index may fairly be said to hold the central place in recent discussion of the population prospects of countries of low fertility. The use of this index has revealed a very striking prospect of population decline in many countries at a time when births still exceeded deaths, sometimes by a considerable margin.

89. The primary significance of the N.R.R. might be summed up in the following statement "A N.R.R. having the value R_o shows that if 'fertility' and 'mortality'(1) remain as they are the population will eventually grow by 100 (R_o — 1) per cent. per generation" (or decline by 100 (1 — R_o) per cent. per generation if $R_o < 1$). This kind of statement is frequently supported by the proposition that a net reproduction rate of R_o means that 1,000 girl babies will produce in the course of their lives 1,000 R_o girl children if "fertility" and "mortality" rates remain as they are. The real basis for the statement that the N.R.R. measures the ultimate rate of growth of the population if "fertility" and "mortality" remain constant is, however, more complex. It is to be found in the mathematical demonstration, first developed by Sharpe and Lotka in 1911, that any population of whatever age distribution would, if subject to constant "fertility" and "mortality" rates, eventually grow at a constant rate. This constant rate of growth per "generation" (in practice about 30 years) is measured by the N.R.R. Clearly the mathematical demonstration of Sharpe and Lotka does not by itself show the importance of the N.R.R. as an index of population growth. While it is true, that "if 'fertility' and 'mortality' remain what they are, the population will ultimately grow at a certain rate", it is equally true that "if the crude birth rates and crude death rates remain what they are, the population will grow at the rate of natural increase". The essential distinction between the two statements is that "fertility" and "mortality" can reasonably be expected to continue into the indefinite future, while crude birth and death rates seem to be obviously less fundamental properties of a population than "fertility" and "mortality" in the relevant sense. The point is that if one supposes that birth rates and death rates continue

(1) These words are here used, as is customary, to denote the rates employed in the calculation of N.R.Rs., i e. "fertility" means the rates obtained by dividing the births born to women of a given age by the population of women of tha age, and "mortality" similarly denotes the rate of the deaths in an age group related to the mean number living. The use of these terms has probably helped to create the impression that "fertility" and "mortality" are somehow real qualities, and not merely, like birth or death rates, the result of a particular arithmetical operation.

as they are it follows necessarily (in the case of many present-day populations) that one assumes that the age structure of the population will not continue as it is, and if the age structure changes the continuance of the same birth and death rates can only come about by an extremely unlikely accident.

90. The essence of recent criticism of the N.R.R. is that the argument for attaching significance to it in preference to the crude rate of natural increase, can be applied to the N.R.R. itself. To assume that "fertility" and "mortality" will continue at the levels of a given year usually implies the assumption that other elements in the situation will change, and these changes will make it extremely unlikely that "fertility" and "mortality" will remain constant. The elements relevant to the problem can be grouped under three main heads. Only a brief summary of the main points of the argument under each head can be given here.

(1) Male and Female N.R.Rs.(1)

91. The N.R.Rs.(2) customarily used are based entirely on the specific fertility and mortality rates of women. It is possible to compute paternal N.R.Rs. by the same methods basing the calculations on the fertility and mortality rates of men. If this is done the result is normally completely at variance with the result of the calculation based on women(3). It is impossible that both the rates of men and the rates of women should remain in operation indefinitely. Can it be argued, as implied in the customary exclusive use of the maternal N.R.R., that the rates of women are likely to continue while those of men will change? The inconsistency between the paternal and maternal measures is due to the fact that the age and sex distribution of the population in the year of observation is not that of the stable population appropriate to the particular masculinity at birth and female "mortality" and "fertility" conditions of the year. This means that as the stable state is approached the proportions of women married at given ages would have to change or else the proportions of men married would have to change. Since the vast majority of births are legitimate the proportions married considerably affect the fertility rates. There seems in fact no good reason for supposing

(1) There is by now a fairly large number of papers bearing on this subject in the literature. For the most thorough account of the conditions of consistency between male and female rates and of the nature of the discrepancies actually found in present-day populations see P. H. Karmel, "The Relations Between Male and Female Reproduction Rates", *Population Studies*, Vol. I, No. 3, December, 1947, and "An Analysis of the Sources and Magnitudes of Inconsistencies between Male and Female Reproduction Rates in Actual Populations", *Population Studies*, Vol. II, No. 2, September, 1948.

For a discussion of the arguments against preferring female rates see J. Hajnal, "Some Comments on Mr. Karmel's paper 'The Relations between Male and Female Reproduction Rates'" and P. H. Karmel, "Rejoinder to Mr. Hajnal's comments", *Population Studies*, Vol. II, No. 3, December, 1948.

(2) The expression N.R.R. refers to the traditional computation based on women only, except where preceded by the word "male" In contexts where male N.R.Rs. are referred to the traditional computation is denoted by the "female N.R.R". Male and female N.R.Rs. are sometimes referred to in the literature as paternal and maternal N.R.Rs. The terms paternal and maternal are used in the present work to denote a distinction which is closely related to that between male and female reproduction rates. See para. 144 and footnote below.

(3) It may be mentioned that owing to the greater mean length of the generation of men the male N.R.R. differs from the female N.R.R. customarily employed even if the two are in fact entirely consistent. For comparing the results of the two computations the true rates of natural increase must be used. This fact impairs the beauty of the reproduction rate in its popular use as a measure of the extent to which "the population is replacing itself". Even if the male and female N.R.R. should happen to be completely consistent there would still be two measures of the "extent to which the population is replacing itself".

that as the relation of the numbers of men in the population to the numbers of women changes the female proportions married are likely to remain constant while the proportions of men married are adjusted as necessary.

(2) The Cohort Problem

92. A number of criticisms of the N.R.R. depend upon the facts that the fertility rates involved in its computation were experienced by different cohorts of women, and, secondly, that marriage and fertility rates have been changing. The fertility experienced at a given age by a cohort of women is clearly influenced by their previous marriage and fertility history. Consider a population in which fertility rates have been changing. If in future the fertility rates upon which the N.R.R. is computed were to remain constant, the women arriving at various ages would have a different experience behind them from the women at those ages in the year of observation. One of the elements in the situation in which the fertility rates were recorded will then have changed and it is unlikely that the fertility rates themselves will remain constant.

93. Under certain circumstances which have occurred fairly frequently in recent years, it can be shown that certain elements of the demographic situation can only have occurred because conditions have not been constant. Such aspects of the situation must change if fertility conditions remain constant. For example, in a period of rising marriage rates, there may be an abnormal proportion of recently married persons in the population, i.e. a proportion which can only arise because the women in the older age groups had in their youth experienced lower marriage rates than the more recent cohorts. If marriage rates had remained constant throughout the life time of the persons concerned, it would not have been possible for so many of them to be married in a short period. Since marriages of recent occurrence have higher fertility rates than marriages of longer duration, changes in the distribution of the population by duration of marriage may alter considerably the age specific fertility rates on which the N.R.R. depends, even if fertility rates specific by duration of marriage remain constant.

94. The fact that proportions ever married can sometimes be shown to be such that they could not be permanently maintained has similar implications for the use of the N.R.R. The proportions ever married in England and Wales in 1947 are an example of such a situation (see para. 26 above).

95. Births of different parity, and first births in particular, provide similar arguments against the significance of the N.R.R. It is possible to split the fertility rates into the components provided by births of each parity. If the components provided by first births are added for all age groups, the total sometimes exceeds 1,000 (if fertility rates are expressed per 1,000). In other words the maintenance of such fertility rates would imply that women had borne on average more than one first birth in the course of their lives. Such a situation can arise because in the year of observation the older women had not had as many first children as they would have had, if they had always experienced the fertility rates of younger women in that year.

96. The essential argument that the maintenance of given specific fertility rates is unlikely, remains the same even in less extreme cases. In recent years fertility rates have been fluctuating so much that the maintenance of the fertility rates of all ages recorded in some years would result in cohorts having many more or many fewer children than any recent cohorts have in fact had.

97. In general it may be shown that changes in marriage and fertility rates will, under certain conditions which are often fulfilled, necessarily involve temporary rises or falls in the N.R.R.—rises and falls which have no significance for the long term prospects of population growth(1).

Possibilities of other Reproduction Rates

98. It is not necessary to abandon the idea of a reproduction rate on account of the qualifications necessary in using the N.R.R. which have been outlined above. In fact the reproduction rate technique is not limited to summarising age specific fertility and mortality rates and it has already been more widely applied. It is only necessary to define a system of rates giving the probability that the occurrence of a birth gives rise after a period of time to the occurrence of another birth. The sum of the probabilities for all ages may be applied to such rates and it may be shown that if they remain continuously in operation the number of births would eventually grow exponentially. In more precise terms this may be stated as follows.

99. Let it be supposed that in an actual population this system of rates remains in operation from a certain moment onwards. At the initial point of time the population may have any distribution whatever as regards the characteristics (age, sex, duration of marriage, etc.) by reference to which the rates in question may be defined. Let us suppose further that according to the system of rates in question no person older than a certain age, say ω years, ever becomes a parent. Then ω years after the point of time when the system of rates begins to operate and at all subsequent points of time the following equation will specify the number of births:

$$B(t) = \int_0^\infty B(t-x)\phi(x)dx \quad \ldots \quad (1)$$

where $B(t)$ is the number of births at time t and $\phi(x)$ is the probability that a birth should produce another birth x years later.

100. Dr. Lotka's analysis(2) has shown that if the above relationship holds then as t grows indefinitely the birth function $B(t)$ will asymptotically approach the form

$$B(t) = B(t-x)e^{rx} \quad \ldots \quad (2)$$

where r is the real root of the equation

$$\int_0^\infty e^{-rx}\phi(x)dx = 1 \quad \ldots \quad (3)$$

Dr. Lotka's analysis does not require that $\phi(x)$ should be defined as the product of the chance of survival to age x and the "fertility" rate at age x as normally understood.

(1) For further discussion see Section D below.

(2) The first proof of a theorem which essentially amounts to that given above was indicated by F. R. Sharpe and A. J. Lotka in "A Problem in Age Distribution", *Philosophical Magazine*, April, 1911. Another line of proof has been indicated by Dr. Lotka in "The Stability of the Normal Age Distribution", *Proceedings of the National Academy of Sciences*, November, 1922. There has been much discussion of the conditions which must be fulfilled by $\phi(x)$ and the original state of the population in order that the asymptotic properties of $B(t)$ may hold. For references, see W. Feller, "The Integral Equation of Renewal Theory", *Annals of Mathematical Statistics*, 1941. It would seem, however, that the theorem indicated is valid under all conditions of practical interest in the demography of human populations. If $\phi(x)$ is discontinuous and concentrated at a number of discrete values of x—and this is the effect of practical procedures of computation—certain special cases may arise (see, e.g., P. H. Leslie "On the use of matrices in certain population mathematics" *Biometrika*, Vol. XXXIII, Part III, November 1945, p. 183).

101. We may, for example, define a system of rates adequate for the purpose described in the following manner. We may suppose that there remain constant indefinitely the probabilities of survival of single women from birth to the end of the childbearing period, the probabilities of marriage for single women at each age, the probability that single women of a given age have a child, the probability of survival for women once married, and the probability that women once married and of given age have a child. The reproduction rates based on such a system of rates have in fact frequently been computed. More complicated calculations have also been made, in particular reproduction rates have been based on marriage rates and rates of legitimate fertility specific by duration of marriage. The computation of reproduction rates is, in fact, a very convenient way of summarizing the consequence for population growth of the indefinite maintenance of given sets of frequencies. If sufficient conditions are specified for the computation of a reproduction rate and for deriving the true rate of natural increase, this means that the set of rates in question, if maintained in operation, and if no migration occurred, would completely determine the future number of births and in the long run births would grow at the rate indicated by the " true rate of natural increase ". The computation of a reproduction rate is a method of summarizing a complicated system of frequencies, in precisely the same way as a life table is a method of summarizing the death rates of the various age groups. The computation of a reproduction rate may in fact be described as an application of life table technique.

102. In the " mean interval between generations ", the number of births would grow in the ratio indicated by the reproduction rate once the stable state had been reached. (The " mean interval between generations " may be roughly defined as the mean length of time between the birth of parents and the birth of their offspring.) Secondly, the reproduction rate may be interpreted as the ratio of the number of births produced by a cohort to the number of births from which they sprang, if the cohort was subject from birth to the frequencies which are used in computing the reproduction rate(1).

103. The N.R.R. is, as has been said, only one form of reproduction rate and it is almost the simplest conceivable. The N.R.R. defines the probability that the occurrence of a birth gives rise to another birth after a given interval simply as the product of two quantities(2). The construction of other reproduction rates (such as those taking account of marriage rates, duration of marriage, etc.) is more complicated both in conception and as a matter of

(1) These statements have been kept vague as regards the distinction between paternal and maternal reproduction rates. In fact any stable population can be characterized both by a paternal and by a maternal reproduction rate and to each of them the statements in the text apply. The relationships are worked out in detail in Chapter VI. It should be noted that the second interpretation of the reproduction rate does not apply to the "parental reproduction rates" introduced in Chapter VI para. 185. A special interpretation applicable to certain reproduction rates is mentioned in paras. 214–219 below.

(2) It is possible to obtain a set of such probabilities even more simply by relating the female births born to mothers of age x to the female births occurring x years ago. If the results of such a calculation are added for all ages of the mother, a reproduction rate is obtained. This reproduction rate differs from the N.R.R. in so far as (1) the mortality actually experienced between birth and childbearing age by the generation having births in the year in question differs from current mortality and (2) the numbers of survivors of these generations who are present in the population have been affected by migration. This reproduction rate measures the ultimate effect on population growth of the indefinite continuance of the current " fertility " rates and the mortality and migration actually experienced by the cohorts of parental age. A similar calculation could, of course, in principle be carried out by grouping the male births by age of father and relating the male births to fathers aged y to the male births occurring y years ago.

computation. Such reproduction rates have normally been regarded by their authors not merely as the application of a useful technique for summarizing a set of frequencies, but as improvements on the N.R.R. They have been claimed as a better approach to the " true " reproduction rate. It may be asked whether by incorporating successive " refinements " in the calculation it may not prove possible to reach a " true " reproduction rate.

104. What are the requirements of the " perfect " reproduction rate? In the first place, it is clear that a reproduction rate should, as far as possible, not be liable to the type of criticism which can so easily be applied to the crude rate of natural increase and also, as has been indicated, to the N.R.R. The rates summarized in the reproduction rate should be such that, as far as possible, their maintenance does not involve any changes which make it unlikely that these rates will continue in operation. Secondly, these rates should be such that they can properly be regarded as reflecting fundamental characteristics of the population and not merely the temporary aspects of the situation in a single year. Otherwise there is no great value in considering their implications from the long run point of view.

105. Can these requirements be fulfilled and is there a unique set of rates which fulfils them? Unfortunately, in the present state of knowledge, the answer must be in the negative. In the first place, no one has yet succeeded in selecting a group of frequencies which suffices to determine a reproduction rate and which is yet not open to the objections levelled against the N.R.R. One main difficulty is that in almost any system for computing reproduction rates, two answers which frequently differ widely are obtained, depending on whether the calculation is based on rates recorded by the male or by the female parts of the population. There are applications of reproduction rate technique in which this point does not arise, but they are not very convincing(1).

106. Another problem is created by the fact that current rates measure the flow of additions to the stock of marriages and births, but this flow must be influenced by the past marriage and fertility history of the cohorts concerned, and these cohorts normally experienced different rates in earlier years. In a situation where all frequencies had been constant for a long time there would be no need for reproduction rates. In effect rates recorded in a given year (or other suitable period) always reflect temporary fluctuations to some extent. These problems are discussed in more detail in Chapter VII.

107. In general it may be said that it is by no means certain that every refinement in the computation of reproduction rates is necessarily an improvement. For example, if separate account is taken of marriage and of the mortality of the married and the unmarried, the result will be that heavier nuptiality results in lighter overall mortality and for this reason alone in a higher reproductivity. Again, as will be shown below, it is by no means certain that it is an improvement to analyse fertility by age at marriage as well as by duration of marriage.

108. The usefulness of the reproduction rate lies, as already stated, in giving an indication of the ultimate rate of population growth resulting from the maintenance of a set of frequencies (of births, deaths, etc.). The computation of a reproduction rate from a set of frequencies and the decision to regard this set as characteristic of the current demographic situation are two separate processes and there is no necessary connection between them. It may be

(1) The computation illustrated in Table 21 may be regarded as such an application of reproduction rate technique. For another see A. H. Pollard, " The Measurement of Reproductivity," *Journal of the Institute of Actuaries*, 1948

extremely interesting to explore the ultimate rate of population growth which would be produced by a set of frequencies which it would be quite impossible to maintain. In order to determine which reproduction rates are "characteristic" of the current situation it is in every case necessary to study the behaviour of the individual birth, marriage and death rates on which the reproduction rates are based. Without such study reproduction rates cannot be correctly interpreted. The attribution of "significance" to reproduction rates is clearly to some extent a matter of personal judgment.

109. Sections A and B of this report have examined the course of marriage and fertility rates in recent years. Reproduction rates based on these marriage and fertility rates will be presented below and an attempt has been made to determine with the help of the conclusions reached in Sections A and B the range within which those reproduction rates which most significantly indicate the present situation probably lie.

The Adequacy of Births to replace the Parental Generation

110. The meaning of the N.R.R. which has been discussed so far is that if fertility and mortality remain what they are the population will ultimately grow in each generation at the rate indicated by the N.R.R. It is in the light of this meaning that the qualifications to the use of the N.R.R. which have been outlined are relevant. It will, however, be felt by many that there is another sense in which the validity of the N.R.R. is not impaired by what has been said. Surely, it might be argued, a N.R.R. which is below one indicates that not enough girl babies are born to "replace" the parental generation and if such a situation continues there will be fewer women of childbearing age than there are now. This is surely a significant fact which is not shown by the ordinary rates of births, deaths, and natural increase. Does this not justify the use of the N.R.R.?

111. The male N.R.R. is, however, surely equally significant as an indicator of the extent to which the population of men of reproductive age is to be replaced by current births. Unless one supposes that the number of women of fertile age is of special significance and the number of men unimportant, the female N.R.R., cannot be used in the customary way as the sole index of "replacement". Moreover, it is necessary to define more precisely what is meant by the replacement of the population of parental age. A given N.R.R. is no precise indication that the female births of the year on which it is based bear any particular relation to the total population of women of childbearing age. The question to what extent births are adequate to replace the present population of women of childbearing age, if construed in what is perhaps its most natural sense, may be answered by the following computation.

(1) Form the ratio of the radix of the life table according to current mortality to the population of women of childbearing age (women between 15 and 50, or whatever ages are regarded as the limits of the childbearing period) in the stationary population.

(2) Form the ratio of births to women between 15 and 50 (or whatever ages are regarded as the limits of the childbearing period) in the year which is under consideration.

(3) Divide the latter ratio by the former, and so obtain an index of the extent to which the total number of women of childbearing age would grow or decline if the number of births per year were constant at the level found in the year under consideration.

This index, which may be termed a replacement rate, has often been regarded as a fairly good approximation to the N.R.R.(1) rather than an index in its own right.

112. The replacement rate has a simple meaning. If the rate is equal to one, it means that if the number of births continues at the level of the year studied and the mortality on which the life table was based remains in operation, there will eventually be in the group on which the computation was based exactly the same number of women as there were in the year of observation. If the rate differs from one, it means that the number of births has to be raised or lowered in the proportion which the rate bears to one if full replacement of the number of women of childbearing age is to be obtained in face of current mortality.

113. An advantage of this index is that it can easily be applied to the male population or to both sexes taken together. The calculation is illustrated in Table 20, based on the births in England and Wales in 1938. The life table used is based on the mortality of 1938–39 (see *Note I*).

TABLE 20

Replacement Rates, England and Wales, 1938

	Live Births 1938	Population aged 15–50 1938 (000s)	Stationary population aged 15–50 (l_0=1,000)	Replacement Rate
Males	318,387	10,715	30,361	·902
Females	302,817	11,421	31,152	·826
Both sexes ..	621,204	22,136	30,747(2)	·863

114. For example, using male births only and relating these to the population of men aged 15–50, we obtain a general fertility rate of $\frac{318,387}{10,715}$ per 1,000. Since 1,000 male births were required according to 1938–39 male mortality to produce a population of 30,361 men in the age groups 15–50 we obtain a replacement rate of

$$\left[\frac{318,387}{10,715,000}\right] \div \left[\frac{1,000}{30,361}\right] = \cdot 902$$

115. It may be mentioned that the technique here employed may be used to measure the "adequacy" of the numbers of the population in any age range to replace the numbers in any older age group. For example, in 1938 in England and Wales there were 6,566,000 persons aged between 10 and 20 and 13,225,000 persons aged between 20 and 40. In the stationary population according to 1938–39 mortality there were 9,194 in the lower and 17,767 in

(1) For the closeness of this approximation see D.V. Glass, *Population Policies and Movements*, Oxford, 1940, p. 393 sqq.

(2) A weighted mean of the two figures for males and females, the weights being proportionate to the numbers of male and female births in 1938.

the higher of these age groups (the radix being 1,000 births). Since

$$\left[\frac{6,566}{13,225}\right] \div \left[\frac{9,194}{17,767}\right] = \cdot 959,$$

the number of persons aged 10–20 in 1938 was inadequate in face of 1938–39 mortality to replace the number of persons aged 20–40, in the sense defined above for births. The number of persons aged 10–20 fell short of that required for replacement by about 4 per cent.(1).

116. A calculation of this character is of particular interest in measuring the adequacy of all the births in a given year to replace the total population in face of current mortality. Since the ratio of births to the total population (multiplied by 1,000) is the birth rate, and the birth rate required to yield a stationary population according to current mortality is the reciprocal of the mean expectation of life, the degree to which births replace the total population in this sense is given by the product of the birth rate and the mean expectation of life(2). For 1938 we have, again using the 1938–39 life table,

$$\frac{15\cdot 1 \times 63\cdot 7}{1,000} = \cdot 962$$

117. In its application to the replacement of the population of childbearing age, the use of the replacement rate may, however, be criticized on the ground that it takes no account of the distribution of women within the reproductive age group. For example, suppose that the replacement rate of a given population is equal to one, and that in this population a far larger proportion of the women aged 15–50 are in the age groups 25–30 than in the stationary population. In such a case the fact that the replacement rate is one does indeed show, that if the number of births and mortality remained constant, the total number of women aged 15–50 would eventually be the same as in the year of observation, but the number aged 25–29 will be very much smaller, and the numbers in other age groups will be bigger. Now in any foreseeable future the rate at which women aged 25–29 have children will exceed the mean "fertility" rate of all women in the age group 15–50. (It would perhaps be possible for an unprecedented rise in the mean age at marriage or for other changes to make this statement untrue, but such a change is most unlikely to occur.) Thus, women in the reproductive age groups will be so distributed by age, that they are likely to produce fewer children than the women who are in the reproductive age groups in the original year of observation. It might, therefore, be argued that by weighting the various age groups in proportion to their "fertility", when computing the replacement rate, one obtains an index which shows how far the maintenance of the current number of births would produce in the reproductive age groups a population of women so distributed as to have the same "reproductive potential" as the population

(1) When this type of calculation is applied to age-groups of the female population such that the mid-points are about 30 years apart, an approximation is obtained to the N.R.R. for the period when the persons in the younger age-group were born. In particular, the calculation made for children under 5 and women of, say, 15–45 gives a very useful approximation to the N.R R. It has frequently been used in the United States. For the closeness of the approximation see A. J. Lotka, "The geographic distribution of intrinsic natural increase in the United States and an examination of the relation between several measures of net reproductivity", *Journal of the American Statistical Association*, Vol. 31, June 1936, p. 273.

(2) This computation was suggested as a measure of replacement by G. H. Knibbs, "Mathematical Theory of Population, of its Character and Fluctuations, and of the Factors which Influence them", *Census of the Commonwealth of Australia*, 1917, Appendix A, Vol. 1, p. 294.

in the year of observation(1). A process of weighting of this kind is in effect precisely the difference between the computation of the N.R.R. and the replacement rate: the latter is the value which the N.R.R. would have if fertility rates at all ages were equal.

118. Whether it is justifiable to use the N.R.R. in this sense depends on whether the relation between the fertility rates of the various age groups is sufficiently constant to make the process of weighting worth while. In fact the distribution of fertility between age groups is sufficiently constant for this purpose. This subject has been explored by authors who wished to find methods of computing the N.R.R. when no tabulation of births by age of the mother was available. It was found that computations using the distribution of fertility rates between age groups found in the most widely differing countries gave very similar results(2). Nevertheless it is clear that in this sense the " replacement rate " is not defined with absolute precision and lies anywhere in the range between the results obtained by using the most divergent weights possible. If the N.R.R. is used to measure replacement in this sense, there is no point in giving it to three places of decimals.

119. This conception of the N.R.R. is also clearly applicable to men or to both sexes jointly. A specimen calculation of a joint rate for the two sexes, again using data for England and Wales in 1938, is given below.

TABLE 21

Computation of Joint N.R.R., England and Wales, 1938

(1) Age Group	(2) Total Population Men and Women 1938 (in thousands)	(3) Distribution of Live Births by age of Mother 1938	(4) Distribution of Live Births by age of Father(3) 1938	(5) Mean of Columns (3) and (4)	(6) Fertility Rate (per 1,000)	(7) Stationary Population, 1938–39 mortality (1,000 Births M & F.)	(8) Births to Stationary Population (6) x (7)
15–19 ...	3,472	25,190	3,604	14,397	4·1	4,580	19
20–24 ...	3,149	146,547	69,394	107,971	34·3	4,531	155
25–29 ...	3,469	200,094	175,816	187,955	54·2	4,474	242
30–34	3,435	145,491	172,882	159,186	46·3	4,415	204
35–39 ...	3,170	77,317	111,013	94,165	29·7	4,347	129
40–44 ..	2,792	24,481	56,422	40,452	14·5	4,259	62
45–49 ...	2,645	2,070	24,939	13,504	5·1	4,139	21
50–54 ...	2,466	14	7,134	3,574	1·4	3,963	6
Totals ..	24,598	621,204	621,204	621,204	189·6	34,708	838

(1) For answering the question whether the number of births is sufficient to produce the same " reproductive " potential as the number of women at present of childbearing age, the mortality that is really relevant is that to which the survivors of births now occurring are likely to be subject in the period before they reach reproductive age. From this point of view, the introduction of the " Effective Reproduction Rate " (E.R.R.) by the Registrar General for England and Wales is justifiable. The E.R.R. is the same as the N.R.R. except for the mortality element. The E.R.R. calculation uses the death rate at each age which is expected to be experienced at that age by the girl babies born in the year to which the E.R.R. relates.

(2) The results are not only similar to one another, they also sometimes distinctly diverge from the " unweighted " replacement rate. Cf. D. V. Glass, *Population Policies and Movements*, Oxford, 1940, p. 398.

(3) The distribution of births by age of father was estimated by the method described in J. Hajnal, " Aspects of Recent Trends in Marriage in England and Wales ", *Population Studies*, Vol. I, No 1, June 1947, Appendix.

120. It will be seen that the "joint N.R.R." for England and Wales in 1938 was 0·838; at the same time the male N.R.R. was 0·881 and the ordinary female N.R.R. 0·808(1).

121. The type of calculation presented in Table 21 has here been introduced as a modification of the simple replacement rate considered above. The reason for this modification was that the replacement rate took no account of the distribution of the population within the reproductive age groups. It might be similarly urged that a computation of the N.R.R. type does not take account of the distribution of the population by duration of marriage, number of children already born, etc. If arguments of this kind are pressed further and further, the concept of a replacement rate would be made to approximate more and more to that of a "reproduction rate" as the term is here used.

122. The alteration to the value of the replacement rate introduced by adjusting for the age distribution (by computing the N.R.R.) is in fact usually slight. It is perhaps better, therefore, to keep to an index which has a very simple meaning and the principle of which can be applied far more widely to answering questions about the replacement of other sections of the population than that of reproductive age. In any case, the concepts of "replacement rate" and "reproduction rate" should be kept distinct.

123. Moreover, as the word "replacement" is used here, there are a variety of replacement calculations which are all equally legitimate because they answer different questions. Even of that special type of replacement calculation which measures the adequacy of the number of births for the replacement of the population of reproductive age, there are several equally legitimate kinds. The extent to which the female population of reproductive age is replaced by current births will, for example, differ from the extent to which the male population of reproductive age is being replaced.

124. The main concern of this report is the analysis of the changes in the number of births in the last 15 years and particularly during and after the war. On these changes "replacement" calculations throw little light. But before passing on, some of the most important information to be obtained from replacement rates about population growth in England and Wales may be briefly summarized.

125. In the years before the war the number of births was insufficient by a considerable margin to replace the population of childbearing age. This insufficiency was smaller in relation to the male population of reproductive age than in relation to the female population. The number of births was also insufficient to replace the total population in face of current mortality. But the degree of insufficiency in this respect was less than in relation to the population of childbearing age. This means that if the number of births had risen to a level adequate to replace the population of childbearing age, and were maintained at that level, there would eventually have resulted a considerable increase in population. In more precise terms, taking the calculation made above on 1938 figures as a basis, let us assume that the number of births were maintained at a level adequate to replace the 1938 female population of childbearing age in face of 1938–39 mortality. In 1938, as may be seen from Table 20, the number of births was 82·6 per cent. of this level, and at the same time 96·2 per cent. of that required to replace the total

(1) These N.R.R.'s were calculated using the mortality of 1938–39. The N.R.R. for 1938 based on 1938 mortality was 0·805 and not 0·808.

population. Consequently full replacement of the 1938 female population of childbearing age would have involved, in the long run, an increase in total population in the ratio of $\frac{\cdot 962}{\cdot 826} = 1\cdot 16$ over the 1938 level (given 1938–39 mortality and assuming that no migration occurs).

126. In the last few years the number of births has undoubtedly been more than sufficient for " replacement ", in whichever sense that term may be used. This fact increases the importance of investigating precisely the increase in the number of births, so that the probability that births will continue at this high level may be assessed. On this last question the course of various kinds of replacement rate yields no information.

CHAPTER VI—RELATIONSHIPS BETWEEN MARRIAGES, BIRTHS AND REPRODUCTION RATES IN A STABLE POPULATION

The Introduction of Marriage Duration

127. The usual treatment of reproduction rates and the stable(1) population is in terms of one sex only. It is desirable to eliminate this deficiency in the theory of reproduction rates, before reproduction rates based on data relating both to men and to women can be properly handled. In dealing with human populations it is much easier to take proper account of both types of data if the frequency of marriage enters explicitly into the calculation of reproduction rates. Accordingly the present treatment of the problems involved is in terms of marriage and the fertility of marriages. It is easy to see, however, that many of the results dealing with the relationships between magnitudes in the stable population can be applied also (with suitable modifications) in cases where it is not desired—for lack of data or for other reasons—to make the frequency of marriage enter into the calculation of a reproduction rate.

128. The precise form of treatment adopted in this report has been chosen because the data available for England and Wales make it possible to calculate reproduction rates by marriage duration. The advantages of this procedure are discussed in the following paragraphs. The rest of the present chapter deals purely with the mathematical relationships holding in a hypothetical stable population and all references to marriages, births etc. should be understood in this sense. The problem of applying the theory to throw light on the behaviour of an actual population is reserved to the next chapter.

128. In view of the recent demographic history of England and Wales it is particularly important to take explicit account of marriage when constructing a reproduction rate more refined than the N.R.R. Moreover, it is also desirable

(1) The relationships investigated here are only those relevant to the number of births, and the term stable population is to be understood to mean a population in which births grow exponentially and all quantities relevant to them (e.g., marriages of persons of given ages) bear a constant ratio to each other at any one instant. It is not necessary to assume in addition that the age structure of the population outside the reproductive ages is also constant, though this assumption is usually implied by the term stable population.

to use fertility rates specific by marriage duration, because an abnormal distribution of the population by duration of marriage has been one of the main disturbances limiting the value of the N.R.R. in recent years. Apart from the importance of eliminating the effects of abnormalities in the distribution of the population by duration of marriage, there is a further special argument for using duration-specific fertility rates in any calculation designed to take explicit account of marriage. The old procedure of dividing the female stationary population at each age into the married and unmarried in accordance with a nuptiality table and then applying to the married the fertility rates of married women specific by age only, and illegitimate fertility rates to the unmarried women, is questionable. For it assumes that the fertility rate of married women of a given age is not affected by changes in nuptiality. For example, consider a population in which marriage rates have been rising and suppose that according to current nuptiality 50 per cent. of women marry before age 22. But the married at present aged between 30–34 nearly all married before the change in marriage rates and most of their generation only married after 25. Then to apply the recorded fertility rate of women aged 30–34 to the stationary population resulting from current nuptiality is to suppose that the fertility rates of each age group are entirely unaffected by the distribution of the married women in the age group by duration of marriage. This assumption is obviously wrong since fertility rates in fact vary considerably with the duration of marriage.

129. There are two main computational procedures(1) for combining a set of fertility rates specific by duration of marriage with a nuptiality table to obtain a reproduction rate. If the computation is carried out in sufficient detail, both methods, being really calculations of the same figure, must give identical results. Method (1) consists of computing a standard population showing the distribution of the female stationary population at each age into married and unmarried, and a sub-division of the married population by duration of marriage. The fertility rates of unmarried women are then applied to the unmarried women of the stationary population and the legitimate fertility rates specific by age at *maternity* and duration of marriage are applied to the married women in the stationary population. The total births to the stationary population, of course, form the reproduction rate(2).

130. Alternatively (2), fertility rates specific by age *at marriage* and duration of marriage may be used. Such rates may also be applied to a suitable standard population, but the calculation can be set out in another way which is most easily explained with the help of certain terms which may be defined as follows. By adding together all the fertility rates relating to the same age at marriage, we

(1) There are a large number of possible variations in detail in this type of calculation. Some of them are not strictly points of computation; for example, the extent to which differences between the mortality of persons of different conjugal conditions are taken into account.

(2) This method has been applied to German, Australian and English data—see "Neue Beiträge zum Deutschen Bevölkerungsproblem", *Sonderheft zu Wirtschaft und Statistik*, No. 15 pp 73 sqq. "Memorandum on some aspects of the decline in the birth rate and the future of the population in Australia", by H. C. Coombs, R. Wilson and S. R. Carver, in *Report of the National Health and Medical Research Council, Eighteenth Session*, Canberra, 1944, p. 19. The English rates were calculated by the Government Actuary's Department. The rates for all three countries are reproduced in J. Hajnal, "The Analysis of Birth Statistics in the Light of the Recent International Recovery of the Birth Rate", *Population Studies*, Vol. I, No. 2, September, 1947, p. 138.

ain the total number of births to marriages contracted at the age in question, ch last until the wife has reached the upper limit of childbearing age. This be called the gross fertility of marriages of brides of that age. By multiplyng the fertility rates at each duration of marriage by the proportion of riages which may be expected to survive to that duration, the "net ility" of marriages of brides of that age is obtained, i.e. the mean number of births which such marriages may be expected to bear allowing for the olution of marriage by death and divorce. (The relation between the gross lity and net fertility of marriage as here defined is the same as that between G.R.R. and the N.R.R.). Reproduction rates may be computed from the fertilities of marriage by multiplying them by the marriages occurring at 1 age in a stationary population subject to the marriage rates in question(1).

31. Illegitimate births may be taken into account if this method is used er by calculating the number of unmarried women at each age and applying itimate fertility rates to them (as in the first method) or, more simply, ncreasing the total of legitimate births in the ratio of all births to legitimate hs recorded in the year whose fertility is being measured. Since illegitimate hs normally form a small proportion of all births, fairly large variations in total of illegitimate births allowed for only affect the reproduction rate htly. This matter is further discussed below.

32. Method (2) is preferable for the purposes in view in this report. In first place, if method (2) is used it requires less labour to compute several erent reproduction rates using the same fertility rates but varying nuptiality imptions. In particular, it is possible to observe properly the effects of ing the age at marriage on the reproduction rates. Secondly, it is far er with method (2) than with method (1) to deal with interrelationships veen male and female nuptiality, e.g. to compute reproduction rates using e nuptiality but fertility rates specific by age of wife at marriage. Method (2) therefore been adopted, and the mathematics of the stable population is efore treated in terms appropriate to this method.

33. In the customary treatment of the stable population, it "fertility" and mortality are constant. For the present purpose, it must specified in more detail that rates of first marriage, rates of dissolution of riage, rates of remarriage and fertility rates by age at marriage and duration narriage are constant(2).

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(1)This method in essence, though with important differences, is that used by C. E. Quensel, "Population Movements in Sweden in Recent Years", *Population Studies*, Vol. 1, No. 1, June, 1947 It was also used by C. Clark and E. Dyne, "Applications of the Karmel formula for reproductivity", *Economic Record*, June, 1946. Messrs. Clark and Dyne obtained their values of the net fertilities of marriage from a tabulation of births by age of the mother at marriage and the year of her marriage. Relating births to the number of marriages occurring in the years from which they sprang, and adding for each group of age at marriage the rates for all the years, Messrs. Clark and Dyne obtained figures of the net fertility of marriage directly and without recourse to calculations about the rate at which marriages are dissolved.

(2)The analysis here set out is based essentially on P. H. Karmel, "The Relations between Male and Female Reproduction Rates", *Population Studies*, Vol. I, No. 3, December, 1947, and J. Hajnal, "Some comments on Mr. Karmel's paper 'The Relations between Male and Female Reproduction Rates'" and P. H. Karmel, "A Rejoinder to Mr. Hajnal's Comments", *Population Studies*, Vol. II, No. 3, December, 1948 The present treatment differs from Mr. Karmel's in some minor points of notation and terminology, as well as in the introduction of marriage duration and in making no distinction between first and subsequent marriages.

The Stable Population

134. Consider then such a stable population with rate of increase r. If the number of births at time t be denoted B(t), the relationship

$$B(t) = B(t-x)e^{rx} \quad \ldots \quad (2)$$

will hold.

135. The number of marriages will also increase at the same rate and the ratio of the number of marriages to the number of births will be constant. The distribution of the marriages between bridegrooms and brides of different ages will also be constant.

136. Let $w(x,y)$ denote the ratio of the number of marriages[1] of brides aged x and bridegrooms aged y to the number of births occurring at the same time.

137. In order to see how the process of computing reproduction rates works out in terms of marriages, we require to know the number, and distribution by age, of the marriages contracted by "cohorts" of men and women, i.e. of marriages contracted by persons born at the same time. We therefore relate the marriages contracted at a given time by persons of given age to the total number of births from which those persons sprang. Now the marriages of brides aged x and bridegrooms aged y may be related to two sets of births, those occurring x years ago when the brides were born and those occurring y years ago when the bridegrooms were born.

138. Let the ratio of marriages of brides aged x and bridegrooms aged y in the stable population to the number of births (of both sexes) y years ago be denoted by $u(x,y)$. Similarly let the ratio of the marriages of brides aged x and bridegrooms aged y to the number of births x years ago be denoted by $\bar{u}(x,y)$.

Then we have in accordance with equation (2)

$$u(x,y) = w(x,y)e^{ry} \quad \ldots \quad (4)$$

and

$$\bar{u}(x,y) = w(x,y)e^{rx} = u(x,y)e^{r(x-y)} \quad \ldots \quad (5)$$

It is convenient to write

$$\int_0^\infty u(x,y)dx = u(y) \qquad \int_0^\infty u(x,y)dy = u(x) \quad \ldots \quad (6)$$

and

$$\int_0^\infty \bar{u}(x,y)dy = \bar{u}(x) \qquad \int_0^\infty \bar{u}(x,y)dx = \bar{u}(y) \quad \ldots \quad (7)$$

139. The meaning of these symbols can then be visualized as follows: If one takes 100 births occurring at the same moment in the stable population and then follows them throughout their lives counting the number of males who marry at each age, then the number of marriages contracted by men of age y will be $100\,u(y)$. Of them $100\,u(x,y)$ will marry women aged x. Most of the brides must of course have been born at a time different from that at which the men whose marriages at various ages are being traced were born. If on the other hand one follows a cohort of 100 births counting the numbers of marriages contracted by the women at each age, it will be found that $100\bar{u}(x)$ will marry at age x, of which $100\bar{u}(x, y)$ will marry men aged y.

[1] No distinction is made for the purposes of this chapter between first marriages and later marriages.

We may refer to the distribution $u(x, y)$ as the distribution of marriages in a generation of men, and $\bar{u}(x, y)$ as the distribution of marriages in a generation of women(1).

140. We may now proceed to a definition of reproduction rates. For the sake of simplicity we shall assume that there are no illegitimate births. Then reproduction rates are obtained by multiplying the values of $u(x, y)$ by the corresponding net fertilities of marriage.

141. Let $b(x, y, t)$ be the number of live births produced by the marriage of a bride aged x and a bridegroom aged y at marriage duration t.

142. Let $F(x,y) = \int_0^\infty b(x, y, t)dt$ denote the gross fertility of marriages of brides aged x and bridegrooms aged y.

143. Let $p(x, y, t)$ denote the chance that a marriage of a bride aged x and bridegroom aged y lasts t years,

and let $F_0(x, y) = \int_0^\infty b(x, y, t,) \, p\,(x, y, t) \, dt$ denote the net fertility of marriages of brides aged x and bridegrooms aged y.

144. We may now define the two reproduction rates, as follows:

Let $$R_{0M} = \int_0^\infty \int_0^\infty u(x, y) \, F_0\,(x, y) \, dx\, dy \qquad (8)$$

and $$R_{0F} = \int_0^\infty \int_0^\infty \bar{u}(x, y) \, F_0\,(x, y) \, dx\, dy \qquad (9)$$

It may be seen that R_{0M} gives the total number of live births produced by the marriages of men born at the same time, while R_{0F} gives the total number of live births produced by a generation if we follow the marriages of the women. R_{0M} and R_{0F} will be termed the "paternal" and "maternal" reproduction

(1) It should be noted that both $u(x, y)$ and $\bar{u}(x, y)$ are obtained by relating the marriages to all births (male and female) occurring at the time when one or other partner to the marriage was born. It might be thought to be more natural to take as the "radix" of $\bar{u}(x, y)$ only the male births, and as the "radix" of $u(x, y)$ only the female births. If this were done the values of $u(x, y)$ and $u(x)$ would be more similar to the numbers of marriages at each age in a nuptiality table for men (or women). If this procedure were adopted it would, however, somewhat complicate the exposition, since the ratio of male to female births would enter into the equations connecting $u(x, y)$ and $\bar{u}(x, y)$. Moreover, in obtaining reproduction rates the procedure adopted above traces the replacement of a complete cohort of births of both sexes, and in the present analysis fertility rates based on births of both sexes are accordingly used. The introduction of two sets of fertility rates, one based on male and one on female births would be a further complication. (Dr. Karmel adopts a somewhat different "radix".) It should be noted also, to avoid confusion, that the terminology here adopted differs somewhat from that used by Dr. Karmel. Dr. Karmel calls the values of $u(x, y)$ the "numbers of marriages in the net joint nuptial population based on male nuptiality" and $\bar{u}(x, y)$ the marriages in the net joint nuptial population based on female nuptiality. The phrase "nuptiality table" is here reserved to a table based on the marriage rates of men (or women) recorded in a given period (in analogy with mortality, fertility and the normal use of the word nuptiality). On the other hand, from the point of view of the present argument, $u(x, y)$ and $\bar{u}(x, y)$ represent certain relationships applicable in a stable population. It is clear that for a stable population constructed by means of, say, the nuptiality of men in a given year, it is possible to compute values of $\bar{u}(x, y)$ and vice versa. Such a calculation is actually carried out below. It seemed best to avoid the term "nuptiality" in connection with $u(x, y)$ and $\bar{u}(x, y)$.

rates respectively(1). The two reproduction rates will differ in value, but they will characterize the same stable population because, since the mean age at fatherhood differs from the mean age at motherhood, the two different reproduction rates correspond to the same true rate of increase.

145. The relation between the reproduction rates and the rate of increase may be derived in the same way as in the traditional analysis relating to the maternal N.R.R. As has been mentioned, Dr. Lotka showed that the true rate of natural increase is the real root of the equation

$$\int_0^\infty e^{-rx}\,\phi(x)\,dx = 1 \qquad \ldots \qquad \ldots \qquad \ldots \qquad (3)$$

where $\phi(x)$ is the chance at birth that a female aged x produce a female child.

146. Now the age of the parent at the birth of the child does not directly enter into the present analysis. The births occurring after t years of marriage to parents who at marriage were aged x and y occur when the mother is aged $x + t$ and the father $y + t$. The true rate of increase is thus the root of the equations(2)

$$\int_0^\infty\int_0^\infty\int_0^\infty e^{-r(y+t)}\,u(x,y)\,b(x,y,t)\,p(x,y,t)\,dx\,dy\,dt = 1 \qquad (10)$$

and
$$\int_0^\infty\int_0^\infty\int_0^\infty e^{-r(x+t)}\,\bar{u}(x,y)\,b(x,y,t)\,p(x,y,t)\,dx\,dy\,dt = 1 \qquad (11)$$

147. These equations may be solved to any desired degree of accuracy by the customary methods(3). The required moments may be defined in the terms of the present analysis as follows.

148. Let $\frac{R_{nM}}{R_{0M}}$ denote the nth moment about zero origin of the distribution of the age of fatherhood. Then we have

$$R_{nM} = \int_0^\infty\int_0^\infty\int_0^\infty (y+t)^n\,u(x,y)\,b(x,y,t)\,p(x,y,t)\,dx\,dy\,dt \qquad (12)$$

R_{nF} may be similarly defined by writing $x + t$ for $y + t$ and $\bar{u}(x, y)$ for $u(x, y)$.

(1) The terms "male (or female) reproduction rate" and "paternal (or maternal) reproduction rate" are in this report used in related but distinct senses. A male reproduction rate is a reproduction rate computed from data relating to an actual population of men. In any stable population, the reproduction rate obtained by allocating births to the ages of their fathers, i.e the measure of growth in an interval corresponding to a paternal generation, is termed the paternal reproduction rate of that stable population. A male reproduction rate, as usually computed, should therefore be treated as a paternal reproduction rate, but to a male reproduction rate, as to any paternal reproduction rate, there corresponds a maternal reproduction rate which measures the same rate of increase expressed over the length of a maternal generation. In the terminology here used such a rate might be described as a "maternal male reproduction rate".

(2) It is obvious that the two equations define the same value of r, provided $u(x, y)=u(x, y)\,e^{r(x-y)}$ as defined by equation (5) above.

(3) cf. e g. A. J. Lotka, "*Théorie Analytique des Associations Biologiques*", Part II, "*Analyse démographique avec application particulière à l'espèce humaine*", p. 69 sqq. It is of course possible also to use the more rarely employed method devised by S. D. Wicksell, see "Nuptiality, Fertility and Reproductivity", *Skandinavisk Aktuarietidskrift*, 1931.

149. It is important to emphasize that there is a difference, not only in the number of marriages and the reproduction rate, depending on whether a generation of men or a generation of women is taken as the basis, but the average number of children born per marriage is also different. Since the net fertility of marriage of each age of bride and bridegroom is taken as given [$F_0(x, y)$] any measure of the overall fertility of marriage in such a stable population must be a weighted average of the values of $F_0(x, y)$. The result will differ according as the distribution by ages of the marriages of a generation of men, or the corresponding distribution for a generation of women is used for weighting. Denoting the mean number of births per marriage in the former sense by F_{0M} and in the latter sense by F_{0F} we have

$$F_{0M} = \frac{\int_0^\infty \int_0^\infty u(x, y)\, F_0\,(x, y)\, dx\, dy}{\int_0^\infty \int_0^\infty u(x, y)\, dx\, dy} \quad \ldots \quad \ldots \quad (13)$$

$$F_{0F} = \frac{\int_0^\infty \int_0^\infty \bar{u}(x, y)\, F_0\,(x, y)\, dx\, dy}{\int_0^\infty \int_0^\infty \bar{u}(x, y)\, dx\, dy} \quad \ldots \quad \ldots \quad (14)$$

150. If, however, we consider not the number of births produced by a generation of men, or by a generation of women, but the number of births to marriages occurring at the same time in the stable population we may define another weighted mean of $F_0(x, y)$. This may be written as follows:

$$\bar{F}_0 = \frac{\int_0^\infty \int_0^\infty w(x, y)\, F_0(x, y)\, dx\, dy}{\int_0^\infty \int_0^\infty w(x, y)\, dx\, dy}$$

$$= \frac{\int_0^\infty \int_0^\infty u(x, y)\, e^{-ry}\, F_0(x, y)\, dx\, dy}{\int_0^\infty \int_0^\infty u(x, y)\, e^{-ry}\, dx\, dy} \quad \ldots \quad \ldots \quad (15)$$

Having thus defined the number of children per marriage we may express the reproduction rates in terms of them.

151. Let us write

$$\int_0^\infty \int_0^\infty u(x, y)\, dx\, dy = \gamma_M \quad \ldots \quad \ldots \quad \ldots \quad (16)$$

and $$\int_0^\infty \int_0^\infty \bar{u}(x, y)\, dx\, dy = \gamma_F \quad \ldots \quad \ldots \quad \ldots \quad (17)$$

Then we have, if there are no illegitimate births:

$$R_{0M} = \gamma_M F_{0M} \text{ and } R_{0F} = \gamma_F F_{0F} \ldots \quad \ldots \quad \ldots \quad (18)$$

The Magnitude of some of the Quantities involved.

152. Finally we may investigate the order of magnitude of the differences between the various functions in the generation of men and the generation of women. As will be seen later, the nature of these differences is of some interest for the practical computation of reproduction rates.

153. The paternal reproduction rate may be regarded as measuring the amount by which the population grows in the interval between the births of fathers and the births of their children. Similarly the maternal reproduction rate measures the rate of growth of the population in the interval between the birth of mothers and the birth of their children. The ratio of the paternal to the maternal reproduction rate is therefore the ratio of the amount of population growth in the one interval to that in the other interval.

154. Similarly the total number of marriages in a generation of men (γ_M) is obtained above by relating the marriages occurring simultaneously in a stable population to the births of the men concerned while the marriages of a generation of women (γ_F) results from relating the marriages occurring simultaneously to the births of the women concerned. Thus the ratio $\frac{\gamma_M}{\gamma_F}$ is roughly the ratio of the growth of population in an interval corresponding to the mean age at marriage of men to its growth in an interval corresponding to the mean age at marriage of women.

155. Since the mean excess of the age of fathers over the age of mothers must be very nearly the same as the mean excess of the age of bridegrooms over the age of brides, we have roughly

$$\frac{R_{0M}}{R_{0F}} \approx \frac{\gamma_M}{\gamma_F} \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (19)$$

and therefore

$$\frac{F_{0M}}{F_{0F}} \approx 1 \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (20)$$

156. In mathematical terms, the quantitative relations between these and other functions may be investigated precisely by the use of infinite series, similar to Dr. Lotka's solution of the fundamental equation (3) by means of a development using cumulants. The application of the method has now been made very simple by Dr. Karmel's elegant use of moment generating and cumulant generating functions[1].

157. We may use series developed in terms of moments or cumulants derived from the distribution of marriages and births *either* in a generation of men *or* in a generation of women. The formulae below are based on the former and on the excess of men's ages over those of women (i.e., in terms of functions of $y-x$).

Accordingly we have

$$\frac{\gamma_F}{\gamma_M} = \frac{\int_0^\infty \int_0^\infty \bar{u}(x, y)\, dx\, dy}{\int_0^\infty \int_0^\infty u(x, y)\, dx\, dy} = \frac{\int_0^\infty \int_0^\infty u(x, y)\, e^{r(x-y)}\, dx\, dy}{\int_0^\infty \int_0^\infty u(x, y)\, dx\, dy} \qquad \ldots \qquad (21)$$

(1) See P. H. Karmel, "The Relations Between Male and Female Nuptiality in a stable population", *Population Studies*, Vol. I No. 4, March, 1948.

158. Let us write $y-x=z$ and

$$\frac{\int_0^\infty u(x, x+z)\,dx}{\int_0^\infty \int_0^\infty u(x, x+z)\,dz\,dx} = \xi(z) \quad \ldots \tag{22}$$

where $\xi(z)$ is thus the proportion of marriages in a generation of men where the excess of the age of bridegroom over that of bride is z.

159. Let us write further $M_z^{(\xi)}$ for the moment generating function and $K_z^{(\xi)}$ for the cumulant generating function of the distribution of the excess of age of bridegrooms over bride, and $\kappa_n^{(\xi)}$ for the nth cumulant of this distribution.

160. Then we have

$$\frac{\gamma_F}{\gamma_M} = \int_0^\infty e^{-rz}\,\xi(z)dz = M_z^{(\xi)}(-r) \quad \ldots \tag{23}$$

and

$$\log_e \frac{\gamma_F}{\gamma_M} = K_z^{(\xi)}(-r) = \sum_{i=1}^{\infty} \frac{(-r)^i}{i!}\,\kappa_i^{(\xi)} \quad \ldots \tag{24}$$

161. Similarly for evaluating

$$\frac{R_{0F}}{R_{0M}} = \frac{\int_0^\infty \int_0^\infty \bar{u}(x, y)\,F_0(x, y)\,dx\,dy}{\int_0^\infty \int_0^\infty u(x, y)\,F_0(x, y)\,dx\,dy}$$

$$= \frac{\int_0^\infty \int_0^\infty u(x, y)\,e^{r(x-y)}\,F_0(x, y)\,dx\,dy}{\int_0^\infty \int_0^\infty u(x, y)\,F_0(x, y)\,dx\,dy} \tag{25}$$

we may write, as before

$$y - x = z$$

$$\frac{\int_0^\infty u(x, x+z)\,F_0(x, x+z)\,dz}{\int_0^\infty \int_0^\infty u(x, x+z)\,F_0(x, x+z)\,dz\,dx} = \eta(z) \quad \ldots \tag{26}$$

and $M_z^{(\eta)}$ and $K_z^{(\eta)}$ for the moment and cumulant generating functions and $\kappa_n^{(\eta)}$ for the cumulants as before.

162. It may easily be seen that $\eta(z)$ represents the frequency of the occurence of the interval z between the age of the father and the age of the mother at the birth of a child. For the difference between the ages of the parents at the birth of a child is of course the same as the difference between their ages at marriage. $\eta(z)$ differs from $\xi(z)$ in that the frequency of the occurrence of the difference z between the ages at marriage is weighted by the productivity of the marriages.

163. As before we have

$$\frac{R_{0F}}{R_{0M}} = M_z^{(\eta)}(-r) \qquad \ldots \qquad (27)$$

and

$$\log_e \frac{R_{0F}}{R_{0M}} = K_z^{(\eta)}(-r) = \sum_{i=1}^{\infty} \frac{(-r)^i}{i!}\,\kappa_i^{(\eta)} \qquad \ldots \qquad (28)$$

Finally for $\frac{F_{0F}}{F_{0M}}$ we have

$$\frac{F_{0F}}{F_{0M}} = \frac{R_{0F}}{R_{0M}} \div \frac{\gamma_F}{\gamma_M} \qquad \ldots \qquad (29)$$

$$\log_e \frac{F_{0F}}{F_{0M}} = \log_e \frac{R_{0F}}{R_{0M}} - \log_e \frac{\gamma_F}{\gamma_M}$$

$$= \sum_{i=1}^{\infty} \frac{(-r)^i}{i!}\left[\kappa_i^{(\eta)} - \kappa_i^{(\xi)}\right] \qquad \ldots \qquad (30)$$

and the first term is sufficient for the values of r which arise in practice. We therefore have for practical calculation

$$\log_e \frac{R_{0F}}{R_{0M}} = -r\kappa_1^{(\eta)} \qquad \ldots \qquad (31)$$

$$\log_e \frac{\gamma_F}{\gamma_M} = -r\kappa_1^{(\xi)} \qquad \ldots \qquad (32)$$

$$\log_e \frac{F_{0F}}{F_{0M}} = -r\left[\kappa_1^{(\eta)} - \kappa_1^{(\xi)}\right] \qquad \ldots \qquad (33)$$

where $\kappa_1^{(\eta)}$ is the mean excess of the age of father over the age of mother and $\kappa_1^{(\xi)}$ the mean excess of the age of bridegroom over the age of the bride, in a generation of men. Usually the former will exceed the latter because the marriages of younger brides are more productive than those of older brides, and the age of the younger bride on average falls short more of that of their bridegrooms than among the older brides(1). Hence $F_{0F} \lesseqgtr F_{0M}$ according as $r \gtreqless 0$.

164. Of course $\gamma_F \gtreqless \gamma_M$ according as $r \lesseqgtr 0$. But it is clear that $\kappa_1(\eta)-\kappa_1(\xi)$ will be small in relation to both $\kappa_1(\eta)$ and $\kappa_1(\xi)$. (In the example worked out below, we have (Table 27): $\kappa_1(\eta)=3\cdot17$, $\kappa_1(\xi) = 2\cdot88$ and accordingly $\kappa_1(\eta) - \kappa_1(\xi)=0\cdot29$). Thus $\frac{F_{0F}}{F_{0M}}$ will be much nearer to unity than $\frac{\gamma_F}{\gamma_M}$. Therefore, if we regard the reproduction rates as products of the numbers of marriages and the numbers of children per marriage in accordance with equations (17) and (18), the difference between the maternal and paternal reproduction rates will be due mainly to the differences between the number

(1) cf. the figures given below (Table 23) for the mean age of bridegrooms marrying brides of given ages. The argument in the text in effect assumes that the net fertility of marriage varies mainly with the age of brides and hardly with that of the bridegroom. This assumption is correct. See below, para. 174.

of marriages in a generation of men and in a generation of women. The discrepancy between the reproduction rates will be due only to a slight extent to the difference between the number of births to a marriage in the two generations. These two sources of difference between the paternal and maternal reproduction rates will operate in the same direction.

165. The relation between F_0 and F_{0M} (or F_{0F}) may be treated by similar methods.

It may be shown that

$$\log_e \frac{\widetilde{F}_0}{F_{0M}} = \sum_{i=0}^{\infty} \frac{(-r)^i}{i!} [\kappa_i(\theta) - \kappa_i(\mu)] \quad \ldots \quad \ldots \quad \ldots \quad (34)$$

or in the first approximation, we may use

$$\log_e \frac{\widetilde{F}_0}{F_{0M}} = -r\,[\kappa_1(\theta) - \kappa_1(\mu)] \quad \ldots \quad \ldots \quad \ldots \quad (35)$$

$\kappa_n(\theta)$ and $\kappa_n(\mu)$ are respectively the nth cumulants of the distributions.

$$\theta(y) = \frac{\int_0^\infty u(x, y)\, F_0(x, y)\, dx}{\int_0^\infty \int_0^\infty u(x, y)\, F_0(x, y)\, dx\, dy} \quad \ldots \quad \ldots \quad (36)$$

and

$$\mu(y) = \frac{\int_0^\infty u(x, y)\, dx}{\int_0^\infty \int_0^\infty u(x, y)\, dx\, dy} \quad \ldots \quad \ldots \quad \ldots \quad (37)$$

166. It may easily be shown that $\kappa_1(\theta)$ is the difference between the mean age at fatherhood and the mean duration of marriage at the occurrence of births in a generation of men. $\kappa_1(\mu)$ is the mean age at marriage of men. The marriages of younger men are more productive than those of older men.

167. Hence if we subtract the mean duration of marriage at which births occur from the mean age of fathers at the birth of their children we shall get a result below the mean age at marriage of men. Thus $\kappa_1(\theta) < \kappa_1(\mu)$ and $\widetilde{F}_0 \gtrless F_{0M}$ as $r \lesseqgtr 0$. $\widetilde{F}_0$ and F_{0F} will thus differ from F_{0M} in opposite directions.

168. $\widetilde{F}_0$ will, however, differ from F_{0M} much more than F_{0F} differs from F_{0M}. This may be inferred from the formulae given because the share of the marriages of young men in the total number of births is very large. Reflection shows that $\kappa_1(\theta)$ may for this reason fall short of $\kappa_1(\eta)$ by a considerable amount. An actual example is given below (see Table 27).

169. The behaviour of $\widetilde{F}_0$ may seem strange at first sight. The explanation is that the marriages taking place at the same moment contain a heavier proportion of marriages of young persons in an increasing stable population than in a stationary one or in a generation of men or women. (The converse holds of a decreasing population.) Consequently, the average number of births produced by the marriages occurring at the same time (i.e., $\widetilde{F}_0$) is reduced in an increasing population below the level of the number of births per marriage in a generation. The difference in this respect between a generation of men and a generation of women (i.e., the difference between $\widetilde{F}_{0M}$ and $\widetilde{F}_{0F}$) is a comparatively minor matter.

An Arithmetical Illustration

170. It may be useful to illustrate the theoretical relationships discussed by the detailed working out of one example. It is convenient to select the figures in such a way as to give one of the stable populations which might be held to arise from the pre-war characteristics of the population of England and Wales.

171. The stable population illustrated is that which would result from the maintenance of the 1938 rates of first marriage of men, 1938 rates of remarriage of men, the 1938 distribution of brides by age for each age group of bridegroom, the 1938 ratio of male to female births and 1939 rates of fertility specific by duration of marriage and age of wife at marriage. The rates of mortality of men and rates of dissolution of marriage by mortality and divorce are for 1938–39(1).

172. Table 22 sets out the values of 10,000 $u(x, y)$ used in this example. The last column of the right hand side of Table 22 is the distribution of marriages according to 1938 male nuptiality as given already in Table 9. It will be recalled that 5,124 male births were taken as the radix of the table, and this number is the share of male births in 10,000 total births divided between the sexes in the ratio recorded in 1938.

173. The distribution of the number of marriages of men of each age [$u(y)$] by the age of their wives was obtained by dividing each marginal total between the various age groups of brides in the proportions in which the men of each age group marrying in 1938 married brides of different ages.

174. To compute a reproduction rate, values of the net fertilities of marriage must be applied to the marriages given in Table 22. Instead of using separate net fertilities for each combination of the age of bride and bridegroom, only the age of wife at marriage has been taken into account. This may be justified because in any case it is probable that taking separate account of the age of husband would make only a very small difference to the result of the calculation(2).

(1) The analysis given above and the technique here illustrated provide a solution to a problem which has occupied Swedish authors, namely that of computing reproduction rates based on *male* nuptiality and on fertility rates specific by duration of marriage and age of *bride*. The Swedish authors do not take the distribution of brides by age in relation to the age of bridegroom as one of the observed characteristics of the population which enters into the stable population. Instead they take account of the relative distribution of marriage rates of women between age groups, but attempt to adjust the level of the marriage rates to be consistent with that of male nuptiality. The method used by C. E. Quensel, in *Population Studies*, Vol. I, No. 1, June 1947 is not satisfactory, for he seems to assume that the number of bachelor marriages in the stable population is equal to the number of spinster marriages—which is not true even in a stationary population—and ignores the differences between the magnitudes in a generation of men and in a generation of women. The latest results of the work of H. Hyrenius are given in "La mesure de la reproduction et de l'accroissement naturel" *Population*, Vol. III, No. 2, April–June 1948. This article appeared after the present report had been written. The method suggested by Hyrenius seems more laborious in computation than that used here. He deals with remarriages by the same method as that employed here (and discussed in connection with Table 9). It is curious that the Swedish authors regard the solution of this problem (which in effect ignores the general level of women's marriage rates) as a solution of the male-female problem (see Chapter VII).

(2) Cf. e.g. *Census of England and Wales*, 1911, Vol. XIII, "*Fertility of Marriages*", Part II, p. XXIX and p. CIXI; J. H. Muller, "Human Fertility in Relation to Ages of Husband and Wife and Duration of Marriage", *Annals of Eugenics*, 1931, Vol. 4 p. 238.

TABLE 22

Marriages of a Generation of Men according to 1938 Marriage Rates of Men and 1938–9 Mortality

Values of 10,000 $u(x, y)$

Age of bride-groom (y)	Age of bride (x)													
	Under 20	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	Total
Under 20	52	20	2	—	—	—	—	—	—	—	—	—	—	74
20–24	349	1,053	227	22	3	—	—	—	—	—	—	—	—	1,654
25–29	108	811	638	108	17	2	—	—	—	—	—	—	—	1,684
30–34	14	151	230	131	34	7	2	1	—	—	—	—	—	570
35–39	3	30	64	68	47	14	5	1	—	—	—	—	—	232
40–44	1	9	23	33	34	24	9	3	1	—	—	—	—	137
45–49	—	3	10	18	23	22	17	7	2	—	—	—	—	102
50–54	—	1	5	8	14	18	17	13	5	1	—	—	—	82
55–59	—	1	2	5	8	12	14	13	11	3	1	—	—	70
60–64 ...	—	1	1	3	5	7	9	11	9	9	4	1	—	60
65–69	—	—	1	1	2	4	6	7	7	7	7	2	—	44
70–74	—	—	—	—	1	2	2	3	4	4	5	3	1	25
75–79 ...	—	—	—	—	—	1	1	1	2	2	2	2	1	12
80 and over	—	—	—	—	—	—	—	—	1	—	1	1	—	3
Total	527	2,080	1,203	397	188	113	82	60	42	26	20	9	2	4,749

175. The values of net fertility of marriage used are derived from 1939 fertility rates and make allowance for the dissolution of marriages at 1938–39 rates of mortality and divorce[1].

176. The computation of the reproduction rate and r is set out in Table 23.

TABLE 23

Computation of Paternal Reproduction Rate
1938 Nuptiality of Men, 1938–9 Mortality, 1939 Fertility

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age of wife at marriage (x)	Number of marriages 10,000 $u(x)$	Number of maternities per marriage of women aged (x)	Number of maternities to generation of men (2)×(3)	Mean duration of marriage at maternity in marriages of women aged (x)	Mean age of bridegrooms marrying brides aged (x)	Mean age at fatherhood (5)+(6)	Computation of R_{1M} (4)×(7)
Under 20	527	3·383	1,783	7·33	23·44	30·77	54,862·9
20–24 ...	2,080	2·236	4,651	6·80	25·51	32·31	150,273 8
25–29 ...	1,203	1·512	1,819	5·52	28·67	34·19	62,191·6
30–34 ...	397	1·049	416	4·18	34·00	38·18	15,882·8
35–39 ...	188	0·510	96	3·17	40·75	43·92	4,216·3
40–44 ..	113	0·128	14	2·89	48·00	50 89	712·5
45–49 ...	82	0·025	2	2·50	53·03	55·53	111·1
Total ...	4,590		8,781				288,251·0

177. The second column consists of the figures in the last row of Table 22. The figures in column (6) give the mean ages at marriage of the bridegrooms marrying brides of each age as given in Table 22[2]. Column (5) gives the mean duration of marriage at the birth of children as derived from the 1939 net fertility rates referred to above.

[1] For the computation of these rates see Note III.

[2] Throughout the calculations here presented the mean age of persons marrying within each age group was taken as the centre point of the age range, 17·5, 22·5, etc. This is not quite right, but there is some compensation because for the age groups over 30, 32·5, 37·5, etc., overstates the mean age. Experiments have shown that the error involved is very slight and any other procedure would create difficulties in deriving $\bar{u}(x, y)$ from $u(x, y)$ and in subsequent calculations.

178. To derive a reproduction rate we need to adjust the sum of columns (4) to allow for the difference between maternities and live births, and for the inclusion of illegitimate births. The former point serves to lower, the latter to raise the total in column (4).

179. In 1939 there were registered 609,136 legitimate maternities and 619,352 live births (legitimate and illegitimate combined).

Thus we have(1)

$$R_{OM} = 0 \cdot 8781 \times \frac{619352}{609136} = 0 \cdot 8926$$

Further

$$\frac{R_{1M}}{R_{OM}} = \frac{288251}{8781} = 32 \cdot 827$$

and

$$r = \frac{1}{32{,}827} \log_e (0 \cdot 8926) = -0 \cdot 00346$$

Having thus obtained the value of r, the whole analysis may be carried out with reference to a generation of women. By means of the formula:

$$\bar{u}(x, y) = u(x, y)\, e^{r(x-y)} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

and with the help of the distribution of marriages in a generation of women thus derived, R_{OF} may be computed as shown in Table 25.

180. Table 24, showing values of $\bar{u}(x, y)$, has been derived from Table 22. Since five-year age groups have been used, we have

$$349\, e^{5\,(0\ 00346)} = 355$$
$$108\, e^{10\,(0\ 00346)} = 112$$
etc.

On the basis of Table 25 we have, in the same way as before,

$$R_{OF} = 0 \cdot 8879 \times 1 \cdot 01647 = 0 \cdot 9025$$

$$\frac{R_{1F}}{R_{OF}} = 29 \cdot 644$$

and $r = \frac{1}{29 \cdot 644} \log_e (0 \cdot 9025) = -0 \cdot 00346$

which is the same as the value previously obtained.

(1) From the theoretical point of view, it is clear that what would be needed to deal correctly with illegitimate births in calculations of this kind would be knowledge of the distribution of illegitimate births by age of father and mother in combination. The method adopted of multiplying the total of legitimate births in a generation by an overall factor and then using the age distribution of the parents of legitimate births in deriving r could be strictly accurate only if the distribution of the ages of the parents of illegitimate births in the stable population were precisely the same as the distribution by age of the parents of legitimate births.

For the computation of reproduction rates in practice it is preferable to estimate the numbers of non-married at each age in a generation of women and apply illegitimate fertility rates to these numbers, since the proportion and age distribution of unmarried women in the population in the year of observation is likely to differ from that in a stationary population. The overall factor method will thus not give the same number of illegitimate births as that obtained if the fertility rates of unmarried women by age in the year of observation are supposed to remain constant.

TABLE 24

Values of 10,000 $\bar{u}(x, y)$

Age of groom (y)	Age of bride (x)													
	Under 20	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	Total
Under 20	52	20	2	—	—	—	—	—	—	—	—	—	—	74
20–24	355	1,053	233	21	3	—	—	—	—	—	—	—	—	1,655
25–29	112	825	638	106	16	2	—	—	—	—	—	—	—	1,699
30–34	15	156	234	131	33	7	2	1	—	—	—	—	—	579
35–39	3	32	66	69	47	14	5	1	—	—	—	—	—	237
40–44	1	10	24	34	35	24	9	3	1	—	—	—	—	141
45–49	—	3	11	19	24	22	17	7	2	—	—	—	—	105
50–54	—	1	6	9	15	19	17	13	5	1	—	—	—	86
55–59	—	1	2	6	9	13	15	13	11	3	1	—	—	74
60–64	—	1	1	3	5	7	10	11	9	9	4	1	—	61
65–69	—	—	1	1	2	4	6	7	7	7	7	2	—	44
70–74	—	—	—	—	1	2	2	3	4	4	5	3	1	25
75–79	—	—	—	—	—	1	1	1	2	2	2	2	1	12
80 and over	—	—	—	—	—	—	—	—	1	—	1	1	—	3
Total	538	2,102	1,208	399	190	115	84	60	42	26	20	9	2	4,795

TABLE 25

Computation of Maternal Reproduction Rate

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age of wife at marriage (x)	Number of marriages in generation of women 10,000 ū (x)	Number of maternities per marriage of women aged x	Number of maternities to generation of women (2)×(3)	Mean duration of marriage at maternity in marriages of women aged x	Mean age of women at marriage	Mean age at motherhood (5)+(6)	Computation of R_{1F} (4)×(7)
Under 20	538	3·383	1,820	7·3	17 5	24·8	45,136·0
20–24 ...	2,102	2·236	4,700	6·8	22 5	29·3	137,710·0
25–29 ...	1,208	1·512	1,826	5·5	27·5	33·0	60,258·0
30–34 .	399	1·049	419	4 2	32 5	36·7	15,377·3
35–39 ...	190	0·510	97	3·2	37 5	40·7	3,947·9
40–44 ..	115	0·128	15	2·9	42·5	45·4	681·0
45–49 ..	84	0·025	2	2·5	47·5	50·0	100·0
Total ...	4,636		8,879				263.210 2

181. Finally various measures of the mean number of children per marriage in the generation of men and the generation of women may be illustrated, since the relations between these measures are of some importance for the subsequent argument. Besides relating the number of legitimate maternities to the total number of marriages in the generation of men or of women respectively, it is of special interest to take the marriages of women under 45 and the marriages of spinsters under 45 as the denominator. No separation between first and subsequent marriages has so far been made. An idea of the number of first marriages in the $u(x, y)$ and $\bar{u}(x, y)$ distributions may be obtained, by assuming that the marriages of women of each age group are divided into those of spinsters and married women in the same proportion as the marriages in the same age group in the 1938 nuptiality distribution reproduced in Table 9. The various measures of the mean number of children per marriage are set out in Table 26 together with the quantities upon which they are based. For each item in Table 26 the ratio of its value in the generation of women to its value when computed for the generation of men is also added.

TABLE 26

Relation of various functions in generation of men and generation of women

(1)	(2)	(3)	(4)
	Generation of men (l_0=5124)	Generation of women (l_0=4876)	Column (3) divided by Column (2)
Sum of legitimate maternities	8,781	8,879	1 011
Total marriages	4,749	4,795	1 010
Marriages of women under 50 ...	4,590	4,636	1 010
Marriages of spinsters under 45 . .	4,285	4,327	1 010
Maternities per marriage . .	1 849	1 852	1 001
Maternities per marriage of women under 50 ..	1 913	1·915	1 001
Maternities per marriage of spinsters under 45 . .	2 049	2·052	1 001

182. The important point brought out by Table 26 is that the measures of the number of births per marriage are almost identical in the generation of men and in the generation of women. The reproduction rates, i.e., the total number of births after allowance for illegitimacy, may be conceived as products of the number of marriages in a generation multiplied by the ratio of births to marriages. In this sense it may be said that the excess of 1·1 per cent. of the maternal over the paternal reproduction rate is due almost entirely to the fact that the number of marriages in a generation of women is 1·0 per cent. greater than in a generation of men. This is in accord with the theoretical analysis presented above (para. 164).

183. The mathematical analysis showed that the differences between the generation of men and the generation of women depend on the differences between the mean ages of men and women at marriage and at parenthood. The relevant figures calculated from the distribution of marriages and births in a generation of men are given in Table 27.

TABLE 27

Mean Ages at Marriage and Parenthood in Generation of Men

	Mean ages of		Difference
	Men	Women	
Age at marriage(1)	29 64	26·76	2·88
Age at parenthood(2)	32 83	29·66	3·17
Difference	3·19	2·90	0·29

(1) Computed from Table 22.

(2) Computed from Table 23 column (4). The mean age at parenthood in each age group was taken as in column (7) of Table 23 for the men and as in column (7) of Table 25 for the women.

It will be seen that the relationship between the quantities in Table 27 is that which was expected on the basis of general considerations. If the figures of Table 27 are inserted in formulae (31), (32) and (33), the figures in the last column of Table 26 are obtained. Further $\kappa_1(\theta)$ may be computed from Table 22. It is found to be 26·35 years. Accordingly $\kappa_1(\theta)-\kappa_1(\mu) = 26{\cdot}35-29{\cdot}63= -3{\cdot}29$. Hence by formula (37) we have

$$\frac{\tilde{F}_0}{F_{0M}}=0.989$$

so that $F_0 = 1{\cdot}829$. The average number of births produced by marriages occurring at the same moment of time, therefore, differs from the number of births per marriage in a generation of men or a generation of women in about the same ratio as the ratio between the paternal and maternal reproduction rate.

The Parental Reproduction Rate

185. The theoretical framework used so far is, however, not very useful for practical application. For both R_{0M} and R_{0F} and r have to be calculated from known values of $u(x, y)$ or $\bar{u}(x, y)$. Now the relationship between $u(x, y)$ and $\bar{u}(x, y)$ in turn involves r. It is therefore only possible to use the formulae so far given by taking *either* $u(x, y)$ *or* $\bar{u}(x, y)$ as given and then computing r ($u(x, y)$ was taken as given in the example presented). In other words a set of quantities characterizing the marriage habits of one sex are taken as a basis and the distribution by age, as well as the total number, of marriages in a generation of the other sex is left to depend on the outcome of the calculation. Reproduction rate technique in this form does not allow us to explore the consequences of assumptions about marriage framed in terms of both sexes(3).

186. Even apart from this problem it is inconvenient to describe the characteristics of the stable population in terms of quantities of which there are two values, one in a generation of men and another in a generation of women. The natural solution is an attempt to define an intermediate concept, which might be termed a " parental generation ". The total number of births in a parental generation would be a parental reproduction rate; similarly one might define the number of marriages in a parental generation and so forth.

187. The most natural definition of a parental reproduction rate is perhaps the arithmetic mean of the paternal and maternal reproduction rates. The number of marriages of men aged y and women aged x in a parental generation may be similarly defined. Let the parental reproduction rate be denoted by G_0 and the number of marriages of men aged y and women aged x in a parental generation by $U(x, y)$. We then have

$$U(x, y) = \tfrac{1}{2}\,[u(x, y) + \bar{u}(x, y)] \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (38)$$

$$G_0 = \tfrac{1}{2}\,[R_{0F} + R_{0M}] = \int_0^\infty \int_0^\infty U(x,y)\, F_0(x,y)\, dx\, dy \quad \ldots\ldots \quad (39)$$

188. The meaning of the parental reproduction rate may be interpreted as follows: If in a stable population one was to select at random 100 persons of both sexes born at the same moment and follow them through their lives,

(3) The problem of making plausible assumptions about the way in which the marriage rates of both sexes would change as the age and sex structure of the population alters to the stable state will be discussed later. The point here is that even if plausible assumptions could be found, reproduction rate technique in the form described would not be applicable to them.

adding up the births of which they are fathers or mothers, the sum will on average be 200 G_0. (This statement is strictly correct only if one may treat as negligible the number of births occurring to parents where the ages of the spouses are exactly equal.) A similar interpretation applies to the other concepts associated with a parental generation. Another way of defining a "parental generation" would be to use a geometric mean instead of an arithmetic one and take as the number of marriages of men aged y and women aged x in a joint generation;

$$U^*(x, y) = \sqrt{u(x, y)\ \bar{u}(x, y)} \qquad (40)$$

189. This procedure appears more complicated than that of taking the arithmetic mean, but the resulting formulae have convenient properties. Starting with the values of $U^*(x, y)$ the other quantities in the stable population can be computed precisely. Thus the equations defining r [equations (9) and (10)] may be written in terms of $U^*(x, y)$.

Since

$$e^{-r(y+t)}u\,(x, y) = e^{-r(x+t)}\,\bar{u}(x, y) = e^{-r(t+\frac{1}{2}x+\frac{1}{2}y)}\,U^*(x, y) \qquad (41)$$

we have

$$\int_0^\infty \int_0^\infty \int_0^\infty e^{-r(t+\frac{1}{2}x+\frac{1}{2}y)}\,U^*(x, y)\,b\,(x, y, t)\,p\,(x, y, t)\,dx\,dy\,dt = 1 \qquad (42)$$

This equation can be solved for r by the usual methods. Writing G_n^* for the expression corresponding to R_n in the usual theory we have

$$G_n^* = \int_0^\infty \int_0^\infty \int_0^\infty (t + \tfrac{1}{2}x + \tfrac{1}{2}y)^n\,U^*(x, y)\,b\,(x, y, t)\,p\,(x, y, t)\,dx\,dy\,dt \qquad (43)$$

In particular, for the parental reproduction rate we find

$$G^*\,(o) = \int_0^\infty \int_0^\infty U^*(x, y)\,F_0(x, y)\,dx\,dy \qquad (44)$$

190. Since $(t+\frac{1}{2}x+\frac{1}{2}y) = \frac{1}{2}(t+x)+\frac{1}{2}(t+y)$ it will be seen that G_1^* is an arithmetic average of the first moments about zero origin of the distribution by age of father and of the distribution by age of mother of the maternities in the $U^*(x, y)\ F_0(x, y)$ distribution. Thus $\frac{G_1^*}{G_0^*}$ is the mean of the age of fatherhood and of the age of motherhood in a "parental generation"(1).

G_0^* may therefore be regarded as a reproduction rate measuring the growth of the stable population in a period of time roughly equal to the mean of the lengths of the paternal and maternal generations.

(1) It may seem surprising at first sight that it is G_0^* and not G_0 (the arithmetic mean of R_{0M} and R_{0F}) which measures the rate of growth over a period equal to the arithmetic means of the periods for which growth is measured by R_{0M} and R_{0F}. However the fact that $\frac{G_1^*}{G_0^*}$ is the arithmetic mean of the age of fatherhood and the age of motherhood in a parental generation has nothing to do with the process of averaging by which the elements in a parental generation were derived from elements in a generation of men and elements in a generation of women. It might be objected that if this is so it has not been shown that G_0^* measures growth over the period stated; but it so happens that the mean age at motherhood is almost exactly the same in a generation of men as in a generation of women (in the arithmetical example given above the two values are 29·66 and 29·64—see paras. 180 and 183 above). The same applies to the mean age at fatherhood. Hence the mean of the age at fatherhood and motherhood in a parental generation is very close to the mean of (1) the age of motherhood in a generation of women, and (2) the age of fatherhood in a generation of men.

191. It will be noted that G_0^* is not the geometric mean of R_{oM} and R_{oF}. It may easily be shown that G_0^* is smaller than the geometric mean of R_{oM} and R_{oF} and the geometric mean is in turn smaller than the arithmetic mean G_0. It follows that G_0 measures the growth of the stable population over a period different from the arithmetic mean of the periods to which R_{oM} and R_{oF} relate.

192. It would, of course, be possible to define many other types of "joint reproduction rates" and investigate their relationships. There would be little point in this. The fact that several such rates may be defined will however be used in the subsequent argument.

CHAPTER VII—SOME PROBLEMS IN THE CONSTRUCTION OF REPRODUCTION RATES

193. The investigation of relationships in the stable population is, as was pointed out in Chapter V, only a preliminary step to tackling the real problem in the application of reproduction rate technique, namely the selection of the rates which are to be combined to form a reproduction rate. It will be recalled that the conclusion was reached that there was no unique set of rates appropriate to a given time and place. There are always a number of alternative sets each of which can with some degree of plausibility be regarded as characterizing the current situation. Each set fulfils the condition that if it were maintained in operation, the population would in the long run approximate to a stable state.

194. Once the decision has been taken to deal with marriages separately there are two main problems to be solved in selecting a set of rates. What frequencies shall be taken to define the number of marriages in a stationary population, and how shall the net fertility of marriages of all ages be defined? Other questions, e.g., methods of dealing with illegitimate births, are relatively subsidiary.

The "Stock" and the "Flow"

195. Both the principal questions may be approached by means of two types of information, first, marriage rates and fertility rates, i.e. indices which measure the rate at which the cohorts in question are reducing the stock of unmarried persons or adding to their stock of births or secondly, measures of the "stock" of marriages or births, i.e. the total number of persons recorded as having married before reaching each age (proportions ever married) or the total number of births cohorts of various marriage periods are recorded as having "achieved" by a given date.

196. Traditionally demographic analysis is directed mainly to the investigation, by means of marriage and fertility rates, of what may perhaps be called the "flow", in contrast to the "stock". Recent developments in England and elsewhere have emphasized that rates measuring the current "flow" often give a misleading indication of the current position, if studied by themselves. This has been discussed in Chapters I and IV. From the point of view of reproduction rate technique, the essential difficulty is that the maintenance of the current rate of "flow" would result in building up a "stock" which differs from the stock of the cohorts whose "flow" is being measured. Since the "flow" must be influenced by the stock in existence, reproduction rates so computed do not give a true picture of the maintenance of the present habits of the population.

197. Careful study of changes in the " stock " achieved by successive cohorts is one of the essential tasks of statistical analysis of population movements and an indispensable background for study of the " flow ". But in connection with reproduction rates the question naturally arises whether it is not possible to combine the two approaches. To some extent the marriage rates (in which the denominator is the population never married) might be held to achieve this. They do take some account of the previous history of the cohort, whereas the fertility rates customarily employed are entirely independent of the previous fertility history of the marriages which experience them(1). It is natural to suggest that births be related to a denominator which takes account of previous fertility, for example by relating the number of nth births to the number of women who have had $n-1$ births(2). Such rates have been combined to form reproduction rates(3).

198. Rates of this sort, however, do not eliminate the " stock-flow " difficulty any more than do marriage rates in which the denominator is the number of never-married persons (cf. Chapter I, para. 25).

199. The general reason for this is that the past experience which essentially influences the rates experienced by a certain cohort at a certain stage in its life is not fully specified by the restriction of the denominator of the rate to never-married persons, persons who had a given number of children, or the like. This point has already been discussed in the case of marriage rates (para. 25). Another example may be set out as follows: Suppose that at the beginning of a certain year p per cent. of women of say 35 years of age are women who have borne four children and four children only, and that this cohort had a high fertility so that these women with four children had been left out of a much larger number who had had four births, but had gone on to have a fifth. Suppose now that the rate at which this group of women had fifth births in the year in question is combined in a reproduction rate with the first-, second-, etc. birth rates of younger women in that year. In a hypothetical cohort of women experiencing these rates we may suppose that the proportion of women aged 35 who have had four births and four only is quite different from p and that these women have had a very different fertility experience

(1) The analogous rates in the cases of marriage would be rates of marriages of persons aged x related to the total population (married and unmarried) aged x. The use of such rates in a reproduction rate calculations might imply the absurd assumption that every man (or woman) marries more than once for the first time in the course of his or her life. The use of fertility rates specific by duration of marriage might imply, if the distribution of births at each duration by parity were assumed constant, that each marriage in the course of its existence would produce more than one first birth. In fact, duration-specific fertility rates are very rarely such as to produce this effect. For example they were never such in Germany in 1933–39. In England and Wales, this level was not reached before 1946, but the first-birth rates by duration of marriage in that year if added result in about one first birth per marriage. The ordinary age—specific fertility rates, however, which are used for computing N.R.R.'s, frequently have this character—cf., e.g., P. K. Whelpton, " Reproduction rates adjusted for Age, Parity, Fecundity and Marriage ", *Jour. Amer. Statist. Assoc.*, December, 1946, p. 502; J. Hajnal, " The Analysis of Births Statistics, etc.", *Population Studies*, Vol. I, No. 2, pp. 157–8.

(2) Such rates (specific also by age of mother) have been published for Italy for 1931 (Mario de Vergottini, " Tavola di fecondità della donna italiana secondo l' età ed il numero dei figli avuti ", *Giornale degli Economisti e Rivista di Statistica*, February, 1937).

(3) See P. K. Whelpton, *Journ. Amer. Statist. Assoc.*, December, 1946. Whelpton uses rates specific by age of mother and by parity, but not by marriage duration (American statistics do not supply data on births by duration of marriage). Reproduction rates so computed are open to some extent to the type of criticism which was levelled above (Chapter VI, para. 128) against reproduction rates taking account of marriage but not of duration of marriage (there being a close analogy in the present context between the frequency of marriage and the frequency of first births).

the higher ages marriage rates instead of proportions married were used. This also weakens the force of objection (2) above. For family size the available statistics do not allow any effort to compute reproduction rates for England and Wales on the basis of "stock" data.(1)

The Male—Female Difficulty

203. In the choice of marriage assumptions for the computation of reproduction rates the difficulty arises that different results are obtained from data derived from the male population and from data derived from the female population. This is so whether the marriage assumptions are based on stock or on flow data. There are thus in principle always at least four different possible reproduction rates corresponding to assumptions as to marriage based on (1) the marriage rates of men, or (2) the marriage rates of women, or (3) proportions married among men, or (4) proportions married among women. In order to simplify the wording only the conflict between male and female marriage rates will be discussed. Everything that is said applies equally to the conflict between male and female proportions married.

204. The fundamental reason for the difficulty has already been discussed in Chapter II. It is due to the fact that marriage rates of men and of women cannot continue indefinitely, at the level actually recorded at a given time. The reproduction rate based on the marriage rates of men measures the rate at which the population would ultimately grow if the marriage rates of men remained in operation indefinitely. It would thus be necessary for the marriage rates of women to adjust themselves, as the age and sex composition of the population changes. To rely exclusively on reproduction rates based on the marriage rates of men is equivalent to assuming that men are the "dominant" sex in determining the frequency of marriage. Similarly a reproduction rate based on the marriage rates of women shows what would happen if these rates remained in operation. To arrive at a unique marriage assumption for reproduction rates, it would be necessary to know how the rates of men and of women would adjust themselves as the composition of the population by age and sex approaches that of a stable population. At present no knowledge is available on this point. Further research may yield some information, but it

(1) "Stock" data have repeatedly been used in calculations of reproduction rates or similar indices. R. Boekh applied the number of children recorded by marriages of various durations at the census to a stationary population in order to obtain the mean number of births per marriage (see "Die Statistische Messung der ehelichen Fruchtbarkeit", *Bulletin de l'Institut International de Statistique*, 1890, p. 159). G. Mortara has calculated conventional N.R.R.'s from the number of children reported to have been born to women at the 1940 census of Brazil (see "*Estudos sôbre a fecundidade e a prolificidade de mulher no Brasil, no conjunto da populaçao e nos diversos grupos de cor*", Instituto Brasileira de Geografia e Estatistica, Rio de Janeiro, 1948). Data of stock type also provide the basis for the methods proposed by J. R. H. Shaul for the calculation of conventional reproduction rates ("Derivation of Total Fertility, Gross and Net Reproduction Rates from Census Statistics of Marriage Fertility", *Journal of the Royal Statistical Society*, Vol. CIX, Part III, 1946, p. 278). Stock data were of course used by these authors, not because they were interested in comparing the results with those which would have been obtained from registration data, but because registration data were not available.

In regard to marriage, stock data, i.e., proportions married, have often been used in reproduction rate calculations, to derive nuptiality tables, and for similar purposes. See, for example, L. R. Connor, "Fertility of Marriage and Population Growth", *Journal of the Royal Statistical Society*, Vol. LXXXIX, 1926, p. 553; *Census of Palestine*, 1931, Vol. I; G. Mortara, "Determinaçao da nupcialidade feminina, segundo a idade no Brasil, con base na apuraçao censitária do estado conjugal, e aplicações ao cálculo da taxa de nupcialidade geral e á construçao de una tábua de nupcialidade", *Revista Brasileira de Estatistica*, Vol. IX, No. 33, Jan.-March, 1948, p. 56; C. Clark and E. Dyne, "Applications of the Karmel Formula for Reproductivity", *Economic Record*, June, 1946.

is unlikely that the problem can be fundamentally solved. There is no reason to suppose that the way in which marriage rates adjust themselves to changes in the distribution of the population by age and sex is the same in all circumstances. It may be, for example, that in one economic and social setting the marriage rates of women are almost equally " resistant " to change with those of men, while in another setting the marriage rates of women might depend entirely on the marriage rates of men and on the supply of men relative to the number of women.

205. Since, however, the same data on marriage rates (and proportions married) are usually available for men as for women, it is natural that both should be taken into account in the computation of a reproduction rate. Such a reproduction rate could be called " a joint reproduction rate ". It would, of course, be possible simply to average the conflicting reproduction rates or true rates of natural increase. The most natural procedure, however, is to try to frame marriage assumptions based on the marriage rates of both men and women.

206. The natural concepts to use in this connection are those derived from the " parental generation ". One may assume a distribution of marriages in a " parental generation " depending both upon the marriage rates of men and upon those of women. The resulting reproduction rate may then be interpreted as a " parental reproduction rate "(1).

207. The distributions of marriages in a stationary populat
the marriage rates of men and those of women provide an obvious starting point for the calculation.

208. For the computation of reproduction rates the distribution of marriages by age of the brides is convenient, and the marriages in a stationary population derived from the marriage rates of men can be distributed by age of brides by the methods previously adopted (see para. 173). Since it is not known whether the marriage rates of men or those of women would prove more " resistant " as the age-sex composition of the population changes, we may take the arithmetic mean between the results obtained from each. A calculation along these lines is illustrated in Table 28. It is based on the rates recorded in England and Wales before the war. Allowing for illegitimate births (as in the case of Tables 23 and 25 above) we obtain a joint reproduction rate of $0{\cdot}8524 \times 1{\cdot}01647 = 0{\cdot}8664$.

209. In interpreting a reproduction rate obtained in this way, it must be remembered that for a given stable population there are different ways of defining a parental reproduction rate. It follows that a given " joint reproduction rate " may be supposed to pertain to different stable populations, depending on its interpretation as one or other type of parental reproduction rate. In other words the assumptions implied in the calculation do not by themselves suffice to specify accurately particular values of the rate of increase (r). The range of uncertainty is, however, negligible for the values of r which occur in practice.

(1) The distinction between a " joint reproduction rate " and a " parental reproduction rate " is the same as that between a " male (or female) reproduction rate " and a " paternal (or maternal) reproduction rate ".

TABLE 28

Calculation of Joint Reproduction Rate

(1) Age of Wife at Marriage (x)	(2) Marriages of women according to 1938 male nuptiality([1])	(3) Marriages of women according to 1938 female nuptiality([2])	(4) Mean of columns (2) and (3)	(5) Number of maternities per marriage	(6) Product of columns (4) and (5)	(7) Mean duration at maternity in marriages of women aged(x)	(8) Mean age of bridegrooms marrying brides aged(x)	(9) Mean age of brides	(10) Mean age at parenthood ([3])	(11) Computation of G_1 (6) × (10)
Under 20 .	527	481	504	3·383	1,705	7·3	23·4	17·5	27·8	47,399
20–24 .	2,080	2,114	2,097	2·236	4,689	6·8	25·5	22·5	30·8	144,421
25–29 ...	1,203	1,011	1,107	1·512	1,674	5·5	28·7	27·5	33·6	56,246
30–34 .	397	283	340	1·049	357	4·2	34·0	32·5	37·5	13,388
35–39 . .	188	141	164	0·510	84	3·2	40·8	37·5	42·4	3,562
40–44 . .	113	85	99	0·128	13	2·9	48·0	42·5	48·2	627
45–49 .	82	65	74	0·025	2	2·5	53·0	47·5	52·8	106
TOTAL .	4,590	4,180	4,385		8,524					265,749

([1]) From Table 23. ([2]) From Table 9. ([3]) Mean of columns (8) and (9) plus column (7).

210. The calculation shown in Table 28(1) can be interpreted as giving G^*, i.e. the figures of marriages in column (4) may be regarded as the geometric means of the marriages in a generation of men and those in a generation of women in the stable population. In that case a precise value of r may be obtained from the data presented in the final columns of the table. We have

$$\frac{G_1^*}{G_0^*} = \frac{265749}{8524} = 31 \cdot 18$$

a

$$r = \frac{1}{31 \cdot 18} \log_e (0 \cdot 8664) = -0 \cdot 00460$$

211. It may be noted incidentally that this calculation takes account of all available types of "flow" rates for England and Wales just before the war, and is probably the most elaborate calculation of reproductivity which can be made by the mechanical process of introducing more and more refinements into the rates used. This fact, however, does not make this reproduction rate a useful index for studying the population of England and Wales.

212. It would probably not be worth while to discuss further the logical niceties raised by the concept of a "joint reproduction rate" and the relationship between frequencies in an actual population and those in the stable population to which the joint reproduction rate applies. One problem may, however, be mentioned. The significance of reproduction rates is connected with the property that they measure the rate at which the population will eventually grow if the conditions upon which they are based continue indefinitely. In this generalized form the proposition can be applied to joint reproduction rates. So far, however, only a more restricted proposition has been proved mathematically, namely that if a given system of rates (fulfilling certain requirements) continued indefinitely, the population would ultimately grow as indicated by the reproduction rate derived from that system of rates. The "joint reproduction rate," however, does not directly summarize any rates which have actually been recorded or are expected to obtain and to remain in operation indefinitely. As has been said, the joint reproduction rate is intended to show the ultimate rate of population growth if the marriage rates of men and those of women both adjusted themselves to the changing age and sex structure of the population in accordance with certain assumptions. The marriage rates would thus approach their ultimate values asymptotically as the age-sex composition of the population (on which the marriages are assumed to depend) approaches that of the stable state. The traditional mathematical proof of the asymptotic behaviour of the rate of change of the number of births therefore does not apply in this case. This theoretical difficulty (which could probably be overcome) is, however, hardly a qualification to the use of joint reproduction rates for practical purposes.

213. As a matter of common sense it seems more natural to work with a parental generation rather than with a generation of men and one of women, and it is also more natural to work with marriage assumptions derived from data for both sexes than with data for one sex only. The joint reproduction rate has therefore much to recommend it. Yet the process of averaging by which the marriage rates of men and women are combined is somewhat arbitrary

(1) It may be noted that the procedure of taking the arithmetic mean which was employed in Table 28 results in a joint parental reproduction rate which is the mean of the (paternal) reproduction rate computed from the marriage rates of men and the (maternal) reproduction rate computed from the marriage rates of women. A simple mean of these two reproduction rates might thus have been taken. If some other method of averaging had been used, a similar result might not apply.

and the two "extreme" values are of interest. However, the two separate reproduction rates based on the marriage rates of men and those of women respectively, will not be completely comparable because the length of a maternal generation differs from that of a paternal generation. It is possible to convert the two reproduction rates into parental reproduction rates. This, however, is not necessary for obtaining the limits which the joint reproduction rate might take, since the joint reproduction rate as computed by the above procedure would only be some kind of mean of the two reproduction rates. For this purpose the two separate reproduction rates may therefore be treated as parental reproduction rates.

A Special Interpretation of Reproduction Rates

214. Reproduction rates in which separate account is taken of marriage may be interpreted in a special way. One of the reasons why reproduction rates have traditionally been used more frequently than true rates of natural increase is that reproduction rates have a more immediate appeal to the imagination. For example, a reproduction rate of 0·9 suggests that people's reproductive behaviour is such that they have 10 per cent. fewer children in the course of their lives than are needed to maintain the number of births in the long run. From the point of view of population policy this gives the slogan: "We must have 10 per cent. more births". On the other hand a true rate of natural increase of —0·003, say, has little meaning for the layman. However, since the paternal and maternal reproduction rates must differ, unless they happen to be unity, there cannot be a single figure showing how far "reproductivity" falls short of "par".

215. If separate account is taken of marriage in the computation of reproduction rates, the traditional interpretation just described can be defended, provided it is applied to the number of births per marriage, rather than to reproductivity as a whole. It has been shown that the number of births per marriage does not differ greatly between a generation of men and a generation of women. So far as the absolute magnitude of the number of births per marriage in a given stable population is concerned the difference between the generation of men and that of women does not arise.

216. For a given stable population there will, of course, still be two rates—the paternal and maternal reproduction rates—which show how far the number of births per marriage must be increased to achieve a constant number of births. These two measures, the paternal and maternal reproduction rates, correspond to two assumptions regarding the resistance of marriage rates to change in the composition of the population by age and sex. For an increase in the number of births per marriage would alter the stable age-structure of the population, and the marriage rates of men or those of women, or both, must change. If the marriage rates of men remain constant and those of women adapt themselves, it would be necessary in order to achieve stationary numbers that the number of births per marriage be multiplied by the reciprocal of the paternal reproduction rate. If, on the other hand, the marriage rates of women remain in operation as the composition of the population by age and sex changes it would be the maternal reproduction rate which indicates the extent to which the number of births per marriage falls short of replacement.

217. We may now apply this to reproduction rates computed from an actual population. The reproduction rate directly computed from the marriage rates (or the proportions married) of men is a paternal reproduction rate, while the reproduction rate directly computed from the marriage rates (or proportions married) of women is a maternal reproduction rate. On the assumption that the marriage basis on which each rate was computed will

persist, each of the rates may be interpreted directly as the proportion by which the number of births per marriage falls short of full "replacement". This is so, though these reproduction rates are not comparable on the normal interpretation of reproduction rates as measuring the ultimate rate of population growth resulting from certain frequencies, for paternal and maternal reproduction rates measure growth over different periods of time. A joint reproduction rate may, of course, be interpreted in a similar sense. Thus, on this interpretation also, the reproduction rates computed from the marriage rates (or proportions married) of men and from those of women may be regarded as extreme limits of the joint reproduction rates. They may be interpreted directly and without adjustment for the difference between the lengths of the paternal and maternal reproduction rates as indices of the deficiency in "replacement", on the assumption that either the marriage habits of men or those of women remain fixed in spite of changes in the structure of the population.

218. This interpretation of reproduction rates is of interest mainly in countries whose reproduction rates are below or near unity, the countries where it has been feared that the population may decline. From the point of view of "population policy" it is particularly desirable to measure the proportionate deficiency in the number of births per marriage, since "population policy" as usually understood (family allowances and so forth) is aimed at increasing the number of births per marriage. In some cases it is hoped to bring about such an increase by encouraging people to marry younger, but attempts to induce people who would not otherwise have married to marry usually play a very minor part (even if this aim is expressly formulated). In many countries there is in fact very little scope for an increase in the proportion of people who marry in the course of their lives.

219. In using reproduction rates to set rough "targets" for population policy, it is, of course, necessary to choose the number of births per marriage entering into the calculation in such a way as to be "significant" of current family building habits, and this must to some extent remain a matter of judgment, in which there is room for doubt.

Cohort Reproduction Rates

220. N.R.R.'s have been computed from the fertility and mortality rates of persons born at the same time, i.e., the rates relating to persons aged 0 in year (A), 1 in year ($A + 1$), and so forth. There is no reason why the idea should not be extended beyond the conventional N.R.R. There is clearly no difficulty in computing a male N.R.R. on these lines and many more complex reproduction rates could also be constructed by taking the rates experienced at various ages by persons born at the same time(1).

221. From the point of view from which reproduction rates have been regarded in the present discussion, "cohort" reproduction rates are not of very great interest; for "cohort" reproduction rates can only be computed

(1) See P. Depoid, "Reproduction nette en Europe depuis l'origine des statistiques de l'état civil", in Statistique Générale de France, *Études Démographiques*, No. 1, (Paris 1941), p. 34; also T. J. Woofter, "Completed Generation Reproduction Rates", *Human Biology*, Vol. 19, No. 3, September 1947. Ordinary net reproduction rates for cohorts were computed only by Depoid. Gross reproduction rates are found in both papers. Depoid also calculated another "net reproduction rate" which purports to give the total number of girls surviving to age 15 produced by the cohort and expressed per 1,000 women in the cohort who are alive at age 15. Woofter calculates a net rate with an allowance for mortality to correspond to the proportion of "daughters who survive to exact ages of mothers at the time when their daughters were born".

from the rates of cohorts which have completed their reproductive lives (or, at any rate, most of their reproductive lives), in other words, cohorts most of whose children were born a long time ago. To discover what would happen if the rates of such cohorts continue in operation is of limited interest.

222. The authors of cohort reproduction rates have, however, primarily had other purposes in mind. It is of some interest to know whether the persons born in a given year, did or did not in the course of their lives produce as many births as those from which they themselves sprang(1). Secondly, cohort reproduction rates are of interest for the same reason that other data on cohorts are of interest. For example, the history of cohort gross reproduction rates will eventually show to what extent the recent rises in the numbers of births were due simply to changes in the distribution of births over the life cycle of successive cohorts. In order to use indices derived from the experience of cohorts in this way, it is not necessary that these indices should be in reproduction rate form. For example, the total fertility rate of successive cohorts would serve the purpose equally well (i.e., the sum of age specific fertility rates relating to all births and not only the births of one sex). Important information may be derived also from the components contributed to the total fertility of successive cohorts by births of each order(2).

223. Cohort reproduction rates are in fact an illustration of one among several techniques by which the experience of cohorts may be analysed. Another example of the same technique, i.e., building up indices from rates recorded in different calendar years but relating to the same cohort, is to be found in Tables 17 and 18 above. The technique has frequently been employed in the study of mortality in the computation of cohort life tables (usually known as " generation life tables ").

224. Another technique for analysing the experience of cohorts is provided by " stock " data, which, it will be recalled, represent the number of a given type of events which have been experienced before a certain date by those members of a cohort who survive to that date. Stock figures would equal indices obtained from the rates relating to a cohort only in certain exceptional circumstances, even if all data were completely accurate. For example, the number of births which women aged 50 in a certain country at a certain time have borne would only be equal to the sum of the age specific fertility rates of women aged 49 the previous year, 48 two years before, and so forth (i.e., the total fertility rate of the cohort) if the incidence of migration and mortality were entirely uncorrelated with fertility(3).

225. Yet a third concept would be the total number of certain events actually experienced by persons born within a given period at a given place. In actual practice it would be difficult to obtain statistical data on this concept, owing to the effects of migration and the length of the period required to follow a cohort through life. Experiments which have been made in order to obtain records of all the deaths of a cohort (for example, in Bavaria in the nineteenth century) have been unsuccessful, but the difficulties are greatest in the case of

(1) Somewhat different purposes are supposed to be served by certain " net reproduction rates " computed by Depoid and Woofter and described in the previous footnote. The concept implied in Woofter's rate has been criticized by A. J. Lotka (see " *Critique de certains indices de reproductivité* ", paper presented to the session of the Union Internationale pour l'étude Scientifique de la Population, Geneva, 1949).

(2) Very important light has been shed on the fertility history of the United States by these means, notably in the work of Whelpton.

(3) For a comparison of results obtained by the two methods for actual data, see T. J. Woofter, " *Completed Generation Reproduction Rates* ", loc. cit.

deaths. This concept is, however, the most natural from the theoretical point of view. For example, the "generation of men" and "generation of women" used in Chapter VI are concepts of this kind.

226. Cohort reproduction rates should be distinguished from the reproduction rates based on stock data discussed above (para. 201). The latter rates are based on data relating to all the different cohorts who are at a certain date within the childbearing ages, and not on data relating to a single cohort at different ages throughout life.

The Relation between Age at Marriage and Fertility(1)

227. So far it has been assumed that reproduction rates computed by applying values of the net fertility of marriages to differing distributions of marriages in a stationary population showed in a significant sense the effect on reproduction rates of varying marriage assumptions. When the same rates of net fertility of marriage are applied to different distributions of marriages in a stationary population the differences in the resulting reproduction rates may be regarded as a combination of two factors, (1) the change in the total number of marriages in a stationary population or, perhaps preferably, the change in the number of marriages of women under say 45, (2) changes in the number of children per marriage of women under say 45, changes which are due to differences in the proportionate distribution by age of the marriages of women under 45. The latter effect is, as will be shown below (Table 30), often more important than the former. The fact that differences in the distribution of marriages by age have so great an effect on the mean number of children per marriage is caused by the great excess of the net fertility of the marriages of young women over those of older women. Not only are women who marry younger exposed longer to the physiological risk of childbearing, but it is also observed in all cases where figures are available that at each duration of marriage the fertility rates of marriages in which the wife was younger at marriage are greater than in marriages where the wife was older at marriage.

228. The procedure so far adopted implies that the fertility of marriages of women of any given age is not affected by changes in the proportion of women who marry at that age. This is not a plausible assumption, for persons who marry young are not a random sample of the population in respect of other characteristics than their age at marriage. For example, there are large differences in the mean age at marriage between social classes. For England and Wales some information is available as to the nuptiality and fertility of occupational groups. Now those who on the whole marry youngest, for example, miners, are those who on the whole have most children, but it is not possible to suppose that it is only the fact that they marry young which causes them to have more children. A particularly clear illustration that persons who marry young are a selected sample of the population with respect to other characteristics relevant to fertility is provided by the large proportion of young brides who are pregnant at marriage. Before the war about 50 per cent. of the marriages of women under 20 took place only because the bride was pregnant(2). This means that the marriages of young brides are selected in that an exceptionally large proportion already started off with one birth and also that they must be selected for physiological fecundity in that the proportion of sterile women among them must be particularly low.

(1) For the subject discussed in this section see R. R. Kuczynski, "*The New Population Statistics*," (Cambridge, 1942), page 30.

(2) *The Registrar General's Statistical Review for England and Wales for the years 1938 and 1939*, Text, page 193.

229. It is clear, therefore, that one must not suppose that if those women who now marry at 24 married at 18, they would have as many children as those who do *now* marry at 18. It is possible that such an increase in the size of family would actually come about simultaneously with a change in marriage age, but in that case the persons who change their marriage habits in this way would also have to change in all sorts of other respects. It is probable that a tendency towards younger marriage would in fact lead to an increase in the size of family in normal circumstances, but it is clear that a calculation in which fertility rates actually experienced are applied to a stationary population in which a far larger proportion of persons than in the actual population marry early, gives a grossly exaggerated impression. No precise significance can be attached to a calculation of this kind. There is, indeed, no satisfactory calculation which would show the effect of changes in the age at marriage on family size. Perhaps some useful results could be obtained, if the material were available, by investigating the association of larger family size with earlier marriage *within* selected social or occupational groups, but there is no permanently valid and true answer to the question: " What is the effect of such and such a change in the marriage age on family size? " The circumstances which cause people to marry early or late are also likely to have an influence on their family building habits—an influence, that is, other than the indirect influence through the age at marriage. It is possible, therefore, that at one time and in one place a lowering of the age at marriage may be accompanied by a large increase in family size, but at another time and in another place the same change in marriage age may not be accompanied by any change in family size or family size may even decline.

230. During the war years there have been large changes in the age at marriage, and the relationship between the fertility rates of persons married at different ages has also changed. This is particularly the case for the first year of marriage, where, owing to the large number of ante-nuptially conceived maternities, the fertility of marriages of young brides used to be very greatly in excess of those of older brides. Since the proportion of marriages in which the bride was pregnant dropped sharply during the war, particularly at young ages, the fertility rates of marriages of different ages showed smaller variations than previously. The same phenomenon can be observed to some extent in marriages of higher duration. This may be due in part to the fact that during the war a greater proportion of young husbands than of older husbands were separated from their wives and therefore the fertility of marriages in which the wife was young dropped more in the early years of the war and increased less in the later years of war than the fertility rates of older marriages. For the purposes of reproduction rates, the effect of these changes may be seen in Table 29.

TABLE 29

Net Fertilities of Marriage according to Fertility Rates of each Year, 1939–44
Dissolution by Death or Divorce at mean 1938–39 Rates throughout
Indices 20–24 = 100

Age at Marriage	Year to which fertility rates relate					
	1939	1940	1941	1942	1943	1944
15–19	151	147	154	143	136	133
20–24	100	100	100	100	100	100
25–29	68	67	66	71	74	74
30–34 ..	47	47	48	49	45	50
35–39	23	23	25	24	21	23
40–44	6	5	6	5	6	5

231. Table 29 shows the ratio of net fertility of marriages of various ages to the net fertility of marriages of brides aged 20–24 for each of the years 1939–44.

232. In view of what has been said it is better not to use values of the net fertility of marriages of each given age group in computing reproduction rates, or making population projections, but to assume a figure for the net fertility of all marriages of women say, under 45. (Some allowance for changes in the distribution of marriages by age may be made if this is desired.) No theoretical objections to this course arise from the fact that in a stable population the net fertility of marriages of all ages differs in a generation of men from its value in a generation of women or in a joint generation. As was shown in Chapter VI above, these differences are very slight, and therefore an index of the number of children per marriage based on fertility rates specific by duration only, as recorded in an actual population, may be used for F_{0M} or F_{0I} in computing reproduction rates(1).

233. If this is done, however, and it is desired to pass from a reproduction rate to a true rate of natural increase it is necessary to make some special assumption about the mean age at parenthood.

CHAPTER VIII—REPRODUCTION RATES FOR ENGLAND AND WALES IN RECENT YEARS

Reproduction Rates for 1938–39

234. The consideration of reproduction rates relating to the population of England and Wales before the war may be conveniently begun with a table giving a set of reproduction rates which are all based on the 1939 net fertilities for each age of wife at marriage (as used in Tables 22, 24 and 27).

TABLE 30

Reproduction Rates: 1939 Net Fertility of Marriage; 1938 Nuptiality and Proportions married

	1938 Male Nuptiality	1938 Female Nuptiality	1938 Proportions ever-married among men	1938 Proportions ever-married among women
Reproduction Rate	·885	835	·853	·767
Legitimate Component	·855	·805	·820	·731
Illegitimate Component	(·030)	·030	(·033)	·036
First marriages of women under 45(2)	428	395	419	365
Births per spinster marriage under 45	2·068	2·041	1·955	2·001

(1) The index of the number of births per marriage must of course be suitable in the sense that it can reasonably be assumed to be applicable in a stationary population, though recorded in an actual population which is not stationary. The measure used in this report and described as the " productivity of marriages " is suitable in this sense. The number of births in a given year divided by the number of marriages in the same year is an example of an index which is not suitable since it would be altered by annual fluctuations in marriages even if the births produced by each marriage remained at a constant level.

(2) The radix is taken as 1,000 births of both sexes (512 male and 488 female). The figures in the column headed " 1938 male nuptiality " agree with the corresponding ones in Tables 22 and 26 except that some figures in the latter tables relate to " maternities " while in Table 30 they have been converted into " live births ".

235. These net fertilities have been applied to the numbers of marriages in stationary populations derived from the male and female nuptiality of 1938 and the proportions single among men and women in 1938 (cf. Table 11). Distributions of marriage by age of wife were obtained from the male nuptiality table and from the proportions single among men by assuming that the men marrying at each age distributed their marriages among brides of various ages in the same proportion as men marrying in 1938 (cf. Table 22). The total of resulting maternities was multiplied by the ratio of legitimate live births in 1939 to legitimate maternities in 1939 to give the legitimate birth component of the reproduction rate. In the case of the second and fourth columns of the table the illegitimate birth component was obtained by (1) relating the illegitimate births born to mothers of each age in 1939 to the number of single women in that age group in 1939, and (2) applying these rates to the single women in the stationary population of women based on the appropriate marriage assumption. For the first and third column an approximate method was used. The number of marriages of women under 25 in a generation was subtracted from 444, the number of women surviving to 25 according to 1939 mortality out of a radix of 488 female births. This figure was taken as an index of the number of unmarried women and multiplied by $0 \cdot 17$ which figure would have given the correct answer for the second and fourth column of the table. Thus, if in the stationary population according to 1938–39 mortality men married so as to keep the 1938 proportions of single men constant and men of each age married women of various ages in the same proportion as in 1938, there would be 247 marriages of women under 25: Now $\frac{444-247}{1{,}000} \times (0 \cdot 17) = 0 \cdot 033$. As a result of this procedure some account was taken of the fact that an increase in the proportion of women marrying young would probably reduce the number of illegitimate births.

236. Reproduction rates computed from the marriage rates and proportions married of men, as given in the first and fourth columns of the table, may be directly interpreted as paternal reproduction rates, while the other rates given are maternal reproduction rates. As explained in the last chapter, these reproduction rates may nevertheless be conveniently compared as the limits of the joint reproduction rate if the marriage habits of one or other sex are assumed to be dominant. They may also be compared as giving the proportion by which the number of births per marriage falls short of the amount necessary to maintain the population at a constant level in the long run.

237. It will be seen that the reproduction rates thus computed vary between ·89 and ·77. It may be argued that neither of the extreme values can be taken as indicative of a long run tendency inherent in the 1939 tendencies of the population. It was argued above (para. 41) that 1938 male nuptiality was so high as to make it very unlikely to be maintained in the long run (in the absence of war or an emigration of men) because there would not be enough women. On the other hand, the proportions ever married among women in 1938 still reflected far lower marriage rates than those of 1938 and the immediately preceding years, and in particular the marriage rates of a period when the " excess " of women in the population was far greater than in a stationary population.

238. By the process referred to in para. 181, the number of marriages of spinsters under 45 implied in each reproduction rate calculation was obtained. By dividing the legitimate component of the reproduction rate by this number of marriages the figures in the last row of Table 29 were derived. These figures are considerably higher than the number of births per marriage in the years before the war derived by relating the legitimate births to a weighted average

of the marriages of previous years. The difference is mainly due to the fact that the distribution of marriages by age of wife implied in the reproduction rate calculations was more heavily weighted at young ages than the marriages which were in existence in 1939. The re-weighting of net fertilities for each age of bride has, as argued above, no precise significance and cannot be taken to measure the extent to which married couples would have more children if they married in accordance with the nuptiality tables used. Since the 1939 fertility rates (on which Table 29 was based) may be regarded as abnormally low, and probably should not be taken as characteristic of pre-war family building habits, we may perhaps use productivity of marriages in 1938, i.e., 1·933, and enquire what the reproduction rates would have been had the number of spinster marriages under 45 in a stationary population been taken in accordance with the cases worked out in Table 29, but the mean number of births produced per marriage been 1·933. We thus obtain from the reproduction rate using 1938 male nuptiality,

$$(428 \times 1{\cdot}933) + 0{\cdot}030 = 0{\cdot}857.$$

Similarly, the lowest reproduction rate, that given in the last column of the table, would be reduced to 0·742. If the 1939 number of births per marriage were used the result would be even lower. On the other hand the achievement in family size in 1938 of marriages of even fairly recent duration exceeded the number of births resulting from the permanent maintenance of 1938 fertility rates.

239. In view of what has been said above about the two extreme bases in regard to marriage (1938 male nuptiality and 1938 proportions ever married among women), it would seem that the most significant reproduction rates relating to England and Wales before the war would fall between 0·75 and 0·86, but would probably be nearer the upper limit.

240. It is of interest to note that the N.R.R. for 1938 (based like the calculations in Table 30 on 1938–39 mortality) was 0·808, i.e., well in the centre of this range. This is due to the fact that while the excess of women was tending to reduce the N.R.R. below the level of the most significant reproduction rates, the abnormal number of recent marriages was tending to raise it and the two effects roughly cancelled out.

Reproduction Rates since the War

241. In view of the abnormal character of the demographic developments of the last few years, no simple answer can be given to the question: "What is the reproductivity of England and Wales today?"

242. The changes since 1939 the influence of which must be taken into account in assessing reproductivity may be classed under four heads.

1. Marriage.
2. Legitimate fertility.
3. Illegitimate fertility.
4. Mortality.

243. To take account of the effect of marriage, Table 30 has been recomputed using distributions of marriages in a stationary population derived from 1942–47 male and female nuptiality and 1947 proportions married. The distribution of marriages by age of bride was derived from the distribution by age of bridegrooms based on male nuptiality and proportions married among men, by assuming that men marrying at each age distributed their marriages between brides of various ages in the same proportions as in 1945. A reproduction rate was also computed using 1938–43 female nuptiality to show the effects of a nuptiality higher than that of 1942–47, a period which includes some years of low marriage rates.

244. All other elements in the calculation (legitimate and illegitimate fertility, mortality) are exactly the same as for Table 30. Table 31 thus shows the difference made by the differences in the figures relating to marriage.

TABLE 31

Reproduction Rates

1939 Net Fertility of Marriage by Age, 1939 Illegitimate Fertility

	1942–47 Male Nuptiality	1942–47 Female Nuptiality	1947 Proportions ever married among Men	1947 Proportions ever married among Women	1938–43 Female Nuptiality
Reproduction rate .	·914	·902	·918	·896	·918
Legitimate Component	·889	·875	·893	·869	·891
Illegitimate Component	(·026)	·027	(025)	027	·027
First marriages of women under 45 .	429	399	429	398	409
Legitimate births per marriage of spinster under 45 . .	2 072	2·192	2 082	2·180	2·178

245. The reproduction rates in Table 31 all fall within a narrow range. They are between ·89 and ·92. They are considerably higher than the reproduction rates in Table 30. This is due only to a small extent to increases in the number of marriages in a generation. The lowest number of spinster marriages under 45 implied in any of the reproduction rates in Table 30 was 365, whereas the corresponding minimum in Table 31 is 398. But the maximum has not increased at all. The reason why the reproduction rates in Table 31 are so much higher than those of Table 30 is that the number of legitimate births to marriages of spinsters under 45 implied in Table 31 is far higher than it would be according to the pre-war marriage assumptions in Table 30. This is due to the lower mean age at marriage of women in the distributions of marriages used for Table 31. As argued above, the effects on family size of lowering the age at marriage are grossly exaggerated by the type of calculation here employed. The increase in reproduction rates over the pre-war level due to a change in the marriage factor should therefore be treated with suspicion.

246. To obtain an idea of the maximum amount which the effect of the war-time changes might be expected to amount to, we may continue for the moment to use net fertilities of marriage specific by age. Substituting 1944 legitimate fertility for that of 1939, but leaving everything else unchanged we obtain Table 32.

247. The reproduction rates in Table 32 are between ·95 and ·98. It will be recalled that the number of births per marriage in 1944 was about 10 per cent. above the 1938 level. Only in 1946 and 1947 have higher figures been obtained. The rates for 1946 and 1947 would clearly raise the reproduction rates above one.

248. In addition to allowing for war-time increases in legitimate fertility, we may use wartime rates of illegitimacy instead of 1939 rates. Taking the maximum level reached by illegitimate fertility during the war, i.e., the rates

of 1945, we obtain an illegitimate fertility component for the reproduction rate of ·076 for 1942–47 female nuptiality. This would bring the reproduction rate using 1942–47 nuptiality, 1944 rates of legitimate fertility and 1945 rates of illegitimate fertility to 1·006. The other reproduction rates in Table 32 would similarly be raised to about one.

TABLE 32

Reproduction Rates

1944 Net Fertility of Marriage by Age, 1939 Illegitimate Fertility

	1942–47 Male Nuptiality	1942–47 Female Nuptiality	1947 Proportions ever married among Men	1947 Proportions ever married among Women	1938–43 Female Nuptiality
Reproduction rate . .	·978	957	·982	·952	·977
Legitimate Component	·952	·930	·957	·925	·950
Illegitimate Component	(·026)	027	(025)	·027	·027
First marriages of women under 45 .	429	399	429	398	409
Legitimate births per marriage of spinster under 45	2·22	2·33	2·23	2·30	2·32

249. The influence which has most certainly raised reproductivity above its pre-war level is the fall in mortality. According to the life table of 1945, about 1·016 times as many persons survive to age 20(1) as would under 1938–39 mortality. Thus the reproduction rate based on 1942–47 female nuptiality, 1944 legitimate and 1945 illegitimate fertility would be raised to 1·02. The result would be even higher on any of the other marriage assumptions of Tables 31 and 32, except that based on the 1947 proportions married among women, which would yield a slightly lower figure.

250. Regarded as indications of the long-run prospects of population growth, such reproduction rates are, however, probably too high for the reasons already referred to. 1944 legitimate fertility and 1945 illegitimate fertility cannot, on the argument of Section B, be regarded as likely to obtain in the future. Moreover, the effect of lowering the age at marriage on family size is overstated in the figures. We may therefore approach the problem in another way and ask what would be the reproduction rates, given that the productivity of marriages is assumed to remain at the 1938 level (1·933), while the marriage and mortality assumptions are those just mentioned. For example, taking 1942–47 female nuptiality we have:

$$0{\cdot}399 \times 1{\cdot}933 \times 1{\cdot}016 = 0{\cdot}785$$

for the legitimate component of the reproduction rate. With 1939 illegitim fertility rates, this gives a reproduction rate of 0·81. Since 1942–47 female nuptiality is below the other marriage assumptions, this figure may be considered the minimum value of the reproductivity of England and Wales at the present day.

(1) The reason why 1945 mortality at ages over 20 is ignored is explained in Computational Note I.

251. The figure of 0·81 is, however, certainly below what may be reasonably considered to represent a reproduction rate characteristic of the population today. For mortality has already fallen below the 1945 level and it is not reasonable, as shown in Section B, to take the 1938 figure for the productivity of marriages combined with 1939 illegitimate fertility rates as representative of present-day family building habits. The lower limit for reproduction rates which may be considered significant today can hardly be placed below 0·83.

252. The upper limit is a much more speculative matter. Taking a 15 per cent. increase over the 1938 number of births per marriage as an extreme allowance, and using 1942–47 male nuptiality which, as explained in Section A, is a high marriage basis, we have for the legitimate component of the reproduction rate:

$$0{\cdot}429 \times 2{\cdot}223 \times 1{\cdot}016 = 0{\cdot}967.$$

253. Allowing for illegitimacy we may say that the upper limit for present day reproductivity is about one. It should, however, be recalled once more that in the present circumstances it is extremely difficult to say anything about the number of births per marriage corresponding to present family building habits.

254. It may be thought that this wide range of "significant" reproduction rates demonstrates the uselessness of computing such rates. This, however, is not so, for the variety of reproduction rates is only a reflection of the limits of knowledge about the demographic prospects. To each reproduction rate there corresponds a population projection which would be obtained by holding constant frequencies of marriage and births actually recorded. The variety of future developments which may arise if these frequencies are assumed to change is, of course, much greater. The fact that, if projections of births are made for age specific fertility rates of women, there is only one projection corresponding to "current fertility", only shows how limited an aspect of the demographic situation of such a country as England is today illuminated by the traditional fertility rates and Net Reproduction Rates.

SECTION D

CHAPTER IX—CHANGES IN PROPORTIONS MARRIED(1)

The general problem

255. It was shown in Sections A and B that the great increase in the number of births which has taken place since 1933 was in the last resort mainly due to shifts of births over the life span of successive cohorts, rather than to increases in the total number of children born to them. It was shown that the great increase in the number of marriages was mainly a consequence of the lowering of the age at marriage and that the rise in legitimate fertility rates was mainly caused by the "postponement" of births in the early war years. Section C dealt with the implications of these phenomena for the rate of growth in the number of births which could be expected in the long run in the light of the present behaviour of the population. The present section deals with another problem raised by the facts treated in Sections A and B. It may be asked: If there has been little change in the ultimate proportion of persons marrying in each cohort, and the size of family which they will ultimately have, how is it possible that the numbers of marriages and births should have increased so greatly?

256. The effect of displacements of vital events over the life span of successive cohorts—such as a change in the age at marriage—has been little studied. In view of the events of recent years it is clear that the problem is of very great importance for demography. The emphasis on the technique of analysis by "stock" instead of "flow" data and the related method of analysis of the rates of cohorts (see para. 223 above) are parts of the same problem. A general treatment would have to deal in completely abstract symbols applicable to any vital events (births, marriages, deaths, etc.), as well as to other phenomena and it would have to be in terms of the various related techniques of analysis by which, as has been mentioned, the "displacement" can be studied ("stock" data, rates of cohorts). The following pages, however, do not purport to give such a general treatment, but a discussion of the problems which arise in connection with recent events in England.

Marriages in England and Wales

257. The problem as it presents itself in England is one of the number of marriages. The main part of the increase in the number of births occurred in legitimate births. Yet if we treat the period 1934–1947, or even the more restricted period 1939–47, as a whole, the rise in legitimate births cannot be attributed to an increase in legitimate fertility rates. If the index denoted here "the productivity of marriages" had remained constant at the pre-war level the number of births over the period 1939–47 as a whole would have been almost exactly the same as it actually was. The main part of the increase in legitimate births was due to an increase in the number of marriages. It was shown in Section A that it was not due to an increase in the marriageable population. It is easily demonstrated that the large number of marriages which occurred was made possible only because marriage rates were changing. These marriages were a consequence of the fact that a change in marriage rates was in progress in the period under consideration. No constant set of marriage rates, however high, could have produced so many marriages, given

(1) Some aspects of the subject here discussed are treated in A. H. Pollard, "The Measurement of Reproductivity", Section 3, *Journal of the Institute of Actuaries*, 1948. See also several papers by A. Landry, e.g. "Notes de démographie pure", *Congrès International de la Population*, Paris 1937, Vol. I, p. 85.

the marriageable population then available. In other words, the high number of marriages recorded could not have occurred had successive cohorts each distributed their marriages over their life-cycle in the same way. It was only because the experience of successive cohorts was different, because a more than normal proportion of the marriages of various cohorts was crowded into a few years, that so large a number of marriages could occur.

258. The point may be illustrated by the calculations set out in Table 33.

TABLE 33(1)

First Marriages of Spinsters under 45 in 1933–35 if 1938 Net Nuptiality had obtained throughout

Age Group (1)	Stationary Population 1938–39 life table l_0=10,000 female births (2)	First marriages in Stationary Population at 1938 marriage rates (3)	Sum of mean Populations of 1933, 1934, and 1935 (000's) (4)	Column (4) divided by Column (2) (5)	Product of Column (5) and Column (3) (6)
15–19 ...	46,238	987	4,594 5	·0994	98
20–24 ...	45,783	4,322	5,287 2	·1155	499
25–29 ..	45,247	2,020	5,334 3	·1179	238
30–34 ...	44,684	493	5,053·8	·1131	56
35–39 ...	44,054	189	4,682·4	·1063	20
40–44 ...	43,275	83	4,396 2	·1016	8
Total ...	269,281	8,094	29,348 4		919

The last column of Table 33 shows what the number of marriages would have been in 1933–35 if 1938 net nuptiality had been in operation in the years before 1933 as well as in the period 1933–35. Table 33 shows that in the conditions envisaged there would have been 919,000 marriages of spinsters under 45 in 1933–35. The number of such marriages was in fact 944,000. Now the 1938 marriage rates on which Table 33 is based were higher than the marriage rates in operation in any year between 1933 and 1935. If permanently maintained these marriage rates would have resulted in a proportion ever married among women aged 40–44 of 89 per cent. whereas in that age group the proportion resulting from the marriage rates in force in 1933–35 was in fact 84 per cent.

259. If the same calculation is carried out for the periods 1936–38, 1939–42, and 1943–46, it is found that there would have been 903,000, 1,172,000 and 1,172,000 marriages of spinsters under 45 respectively if 1938 net nuptiality had been in operation throughout the periods considered. This result substantiates the statement made above that the increase in the number of marriages was not due to changes in the population of marriageable age, for the mean number of marriages on this calculation will be seen to fall from 306,000 in the period 1933–35 to 293,000 in 1939–46. The actual numbers of marriages of spinsters under 45 in the three periods considered were 1,003,000, 1,548,000, and 1,229,000. It is of interest to carry out the same calculation, not on 1938 nuptiality, but on the nuptiality of 1938–43, in other words on marriage rates far in excess of the average level recorded in the period. If this is done, it is found that the number of marriages in each period considered would have been slightly higher than on the previous calculation, because the permanent

(1) The figures in columns (2) and (3) are taken respectively from Table A of *Computational Note I* and Table A of *Note II* below.

operation of 1938–43 marriage rates would have meant that a larger proportion of women would get married before reaching age 45, than with 1938 marriage rates. In fact, if 1938–43 rates had been in operation throughout, the number of marriages of spinsters under 45 in the periods 1933–35, 1936–38, 1939–42, and 1943–46 would have been respectively 942,000, 929,000, 1,209,000, and 1,203,000. It will be seen that even on this calculation the number of marriages is below that actually recorded in every one of the periods considered. This is particularly so, of course, in 1939–42, the time when the proportions married were changing most rapidly.

The problem in terms of proportions married

260. The general problem described in paragraphs 255 and 256 will accordingly be treated here in terms of marriages. The " stock " measure used will be proportions married. The formulae developed are applicable to other " stock-flow " relationships.

261. Throughout this chapter consideration is restricted to first marriages, and the term " marriage " means first marriage, while " proportions married " means " proportions ever-married ".

The effect of changes in the age at marriage

262. The nature of the problem may be displayed in a highly over-simplified case. Suppose that in a certain population (in which the same number of persons reach their nineteenth birthday every year and no one aged between 19 and 21 ever dies) there is a custom that everyone marries on their twentieth birthday. It is clear that the number of marriages will be constant from year to year. Now suppose that suddenly there is a decision that from January 1st of a certain year everyone reaching their nineteenth birthday should marry. Everyone who is already over 19, but under 20 and therefore still unmarried also marries within the year. Then in this year the number of marriages will be twice as great as previously. For everyone who would have got married under the old system marries within the year, and in addition there are the marriages of an equal number of people who would on the old system have married in the subsequent year on reaching their 20th birthday. After the year in which the change in the age at marriage takes place the number of marriages will be constant again at the previous level. It might be thought that there would be a diminution in the number of marriages to compensate for the temporary rise in the number of marriages above the number of those reaching marriageable age. But there will be no diminution so long as the age at marriage does not alter.

263. If, on the other hand, the age at marriage were raised (instead of being lowered) by one year, if it were decided that, from 1st January of a given year, people should marry on reaching their 21st birthday, there would be a year in which no marriages were celebrated at all. After that the number of marriages would again be constant at its previous level as long as the age at marriage remained unchanged.

264. It will be seen, therefore, that under the conditions stated, changes in marriage habits have a considerable effect on the number of marriages for a short period, but none at all in the long run.

265. To assess the scale of this effect for a more general case, we proceed to consider a population in which marriages take place over a whole range of ages, say from age l to age L. No person aged between l and L ever dies. In each year a certain number, say B, persons arrive at age l. The proportion of persons at age x who have married is $N(x)$.

266. In such a population the annual number of marriages between x and $x + dx$ is given by

$$BN(x)\, dx \quad \ldots \quad (1)$$

The total number of marriages per year at all ages is obviously

$$B \int_l^L N(x)dx = BN(L) \quad \ldots \quad (2)$$

Now suppose that over a period of years the proportions married gradually change. At the beginning of the period the proportion of persons married at age x was, say $N_1(x)$ and after the change it was $N_2(x)$. In addition we shall suppose that the proportions of persons married at age L remains unchanged,

i.e. $$N_1(L) = N_2(L)$$

Apart from this restriction $N_1(x)$ may be greater or smaller for any or all ages than $N_2(x)$.

267. We now consider what takes place in the period when the proportions married are changing. Suppose this period takes g years, say from year a to year b. The marriages in the transition period may be considered in three groups:

(1) Of those aged l to $l + g$ at time b, none can have married before time a. Between a and b there will have been

$$\int_l^{l+g} N_2(x)dx$$

marriages in this group.

(2) Of those who at time b were aged between $l + g$ and L som ehad married before time a. At time a these persons were aged between l and and $L-g$ and the number who had been married was

$$B \int_l^{L-g} N_1(x)dx \quad \ldots \quad (3)$$

At time b the number who had been married among this group was

$$B \int_{l+g}^{L} N_2(x)dx \quad \ldots \quad (4)$$

Therefore the number of marriages in this group between a and b was

$$B \int_{l+g}^{L} N_2(x)dx - B \int_l^{L-g} N_1(x)dx \quad \ldots \quad (5)$$

(3) Finally we must consider those who at time a were aged between $L-g$ and L, and at time b between L and $L + g$. At time a there were

$$B \int_{L-g}^{L} N_1(x)dx$$

married persons among them. In the period from a to b, the number of married persons who reached age L was $gBN_1(L)$. Thus among this group of persons the number of marriages was

$$gBN_1(L) - B \int_{L-g}^{L} N_1(x)dx \quad \ldots \quad (6)$$

ding up the total number of marriages under all three heads we obtain

$$gBN_1(L) + B\int_l^L N_2(x)dx - B\int_l^L N_1(x)dx$$

$$= gBN_1(L) + B\int_l^L [N_2(x) - N_1(x)]\,dx \qquad .. \qquad (7)$$

268. The number of marriages per annum both before a and after b is BN_1 (L). At this rate there would have been g BN_1 (L) marriages in g years, and therefore the second term of equation (7) represents the number of "excess" marriages.

269. It should be noted that this term may be positive or negative. It will be negative if $N_2(x) < N_1(x)$ for sufficient values of x—i.e., if, on the whole, fewer people have married before given ages after the change in proportions married has taken place. Now, as has already been seen, if the age at marriage is raised, there are fewer marriages in the transition period than before or after. The term "excess" marriages is used here also to cover either a positive or negative excess, i.e., to include the temporary "deficit" of marriages.

270. What the number of "excess" marriages is may be visualized by considering that the mean age at marriage, or the mean number of years lived in the single state by those who afterwards marry, in a population subject to marriage proportions $N(x)$ is

$$\frac{\int_l^L [N(L) - N(x)]\,dx}{N(L)} + l \qquad .. \qquad .. \qquad .. \qquad (8)$$

(This formula is analogous to the well-known formula

$$\mathring{e}_0 = \int_0^\infty l_x\,dx.$$

$N(L) - N(x)$ is the proportion at age x who are *not* married, but *will* afterwards marry and this may be regarded as equivalent to the proportion surviving. It will be remembered the mean expectation of life at birth is also the mean age at death in a stationary population.)

271. The difference between the mean ages at marriage according to the two gross nuptiality tables characterized by $N_2(x)$ and $N_1(x)$ respectively is

$$\frac{1}{N_1(L)}\int_l^L [N_1(\mathrm{L}) - N_1(x)]dx - \frac{1}{N_2(L)}\int_l^L [N_2(L) - N_2(x)]dx$$

$$= \frac{1}{N_1(L)}\int_l^L [N_2(x) - N_1(x)]\,dx \qquad .. \qquad (9)$$

(since $N_1(L) = N_2(L)$ according to the assumptions made).

The "excess" marriages in equation (7) may therefore be written

$$B\int_l^L [N_2(x) - N_1(x)]dx$$

$$= B\,N_1(L)\frac{\int_l^L [N_2(x) - N_1(x)]dx}{N_1(L)} \qquad .. \qquad (10)$$

272. Now $BN_1(L)$ is the number of marriages normally occurring within a year. Equation (10) therefore means that under the restrictive assumptions made, *a change in marriage habits will result in the transition period in an "excess" (or "deficiency") of marriages, which is equal to the number of marriages normally occurring in the period of time by which the mean age at marriage is lowered (or raised).*

273. If we abandon the assumption that $N_1(L) = N_2(L)$ (i.e., if we suppose that marriage habits change in such a way as to alter not only the age at marriage, but the proportion of persons who ultimately marry) the total number of marriages occurring between a and b is no longer defined completely if the values $N_1(x)$ and $N_2(x)$ for all ages between l and L are given. The considerations under (3) above are no longer completely applicable. The total number of marriages in the transition period depends on how many of those who are still of marriageable age at time a but will be over age L by time b, will marry before reaching age L. We may, however, easily set limits to the number of marriages in the transition period by making certain plausible assumptions. Suppose we take the case in which the age at marriage is reduced and more people marry ultimately—a case very frequent in modern Europe—i.e., $N_2(x) > N_1(x)$ for all values of x including L. Then we may suppose that those aged between L and $L-g$ at time a will continue to marry at least at the old rate. Then the number of marriages among them will be the same as that given by equation (6) and the total number of marriages in the transitional period will be greater than that given by equation (7). Nothing more definite can be said, without making additional assumptions.

274. It is not certain whether in this case the total number of marriages in the transition period will be greater than that which would have occurred had the annual number of marriages remained throughout at the level obtaining after time b, (i.e., $B\,N_2(L)$ marriages per annum).

It will easily be seen that if

$$\int_l^L [N_2(x) - N_1(x)]dx < g[N_2(L) - N_1(L)] \qquad .. \qquad (11)$$

the number of marriages may never rise to a level from which it must afterwards fall. (Conversely, if $N_2(x) < N_1(x)$, then this inequality means that the number of marriages need never fall below a level from which it must afterwards rise). It can, however, easily be shown that this inequality is likely to be unfulfilled in many instances in the real world. The proportion of women ever married by, say age 50, has varied in England and Wales between about $\cdot 84$ and $\cdot 88$. If we admit more than twice this range as possible we obtain $N_2(L) - N_1(L) = 0\cdot 1$, say, as a maximum. It is hardly likely that such a change would take place in a short space of time. On the other hand such changes in the mean age at marriage as have a considerably larger effect in the form of "excess" marriages can occur in a very short time.

275. The magnitudes involved may be illustrated by recent changes in proportions married in England and Wales. The following table shows the change in proportions married among women between 1938 and 1942. Since, to two places of decimals, the proportion married among women in the age group 40–44 remained at $\cdot 82$ the figures in the table have been rounded to two places so as to give $N_1(L) = N_2(L)$. Since quinquennial age groups have been used, the expression

$$\frac{1}{N(L)} \int_{15}^{44} [N_2(x) - N_1(x)]\, dx \text{ may be computed as } \frac{5 \times 0\cdot 24}{\cdot 82} = 1\cdot 5$$

TABLE 33

Changes in proportions married, 1938–1942

(1) Age group	(2) Proportion married at end of 1938(1)	(3) Proportion married at end of 1942(1)	(4) Column (3) minus Column (2)
15–19	·03	·04	·01
20–24	·34	·43	·09
25–29	·65	·73	·08
30–34	·75	·80	·05
35–39	·80	·81	·01
40–44	·82	·82	—
Total			·24

It follows, therefore, that the changes in proportions married occuring within the four years covered by the table, imply the " excess " occurrence of $1\frac{1}{2}$ times the normal annual total of marriages.

" Excess " Marriages without changes in the age at marriage

276. Though " excess " marriages as a necessary consequence of a change in proportions married only occur when this change implies a change in the mean age at marriage, similar phenomena may occur even if proportions married do not change so as to imply a change in the mean age at marriage. Consider, as before, a change from proportion married denoted by say $N_1(x)$ to a position denoted by $N_2(x)$, but in this case let

$$N_2(x) = pN_1(x) \quad \quad .. \quad .. \quad .. \quad .. \quad (12)$$

for all values of x, including L. p may be any positive number (in practice it will be in the neighbourhood of 1). All other conditions are assumed to remain the same as in the previous section. The distribution of marriages between ages is therefore exactly the same after the change as before it, but the number of marriages at each age is changed by a constant factor p.

277. We may consider various ways in which the change may take place. Suppose first that all cohorts previous to that aged l at time a continue in the old habits. All subsequent cohorts marry in accordance with the new system, On this assumption the transition period is exactly $L—l$ years long(2). In the transition period, persons aged between l and L at time a will have a total of marriages given by the expression:

$$B\,(L - l)\,N_1(L) - B\int_l^L N_1(x)dx \quad . \quad .. \quad .. \quad (13)$$

(1) These figures, and the figures used in succeeding tables, for the proportions married at the ends of calendar years are the means of mid-year estimates for the same and the following years.

(2) A less drastic assumption would give the same result. One might assume that from time a, successive cohorts each experience a somewhat different set of proportions married, until the transition is complete; in the set experienced by any one cohort, the proportion married at every age would be a constant multiple of the original proportion for that age, i.e. every cohort would distribute its marriages over different ages in exactly the same proportions. Under this assumption there would still be no " excess " marriages.

The cohorts entering the marriageable ages in the transition period will have

$$B \int_l^L N_2(x)dx = pB \int_l^L N_1(x)dx \quad \ldots \quad \ldots \quad \ldots \quad (14)$$

marriages. The total number of marriages is therefore

$$B\,(L - l)\, N_1(L) + (p - 1) B \int_l^L N_1(x)dx \quad \ldots$$

278. It may easily be seen that this number of marriages is intermediate between that which would have occurred had marriages continued at the old rate and that which would have occurred if the number of marriages had always been the same as after the change. For under the old conditions there would have occurred

$$B\,(L - l)\, N_1(L) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (16)$$

marriages in the transition period of L—l years. At the annual rate obtaining after the change a period of L—l years would have witnessed

$$pBN_1(L) = B\,(L - l)\, N_1(L)$$
$$+ (p - 1)\, B\,(L - l)\, N_1(L) \quad \ldots \quad \ldots \quad (17)$$

Since by definition

$$\int_l^L N_1(x)dx < (L - l)\, N_1(x) \quad \ldots \quad \ldots \quad (18)$$

the absolute value of the last term of the right hand side of equation (15) is less than that of the last term in equation (18). It follows that the average annual number of marriages in the transition period is intermediate between the annual number before and after the change.

279. A second way in which the change may take place is that all the cohorts who are of marriageable age at time a marry so that they reach the proportion married $N_2(L)$ when they pass beyond the limits of marriageable age. (This extreme assumption cannot in practice be completely fulfilled. It will usually be logically impossible to fulfil it exactly when $p < 1$). Under these conditions the total of marriages in the transition period becomes:

$$pB\,(L - l)\, N_1(L) + (p - 1)\, B \int_l^L N_1(x)dx \quad \ldots \quad (19)$$

280. The first term represents the number of marriages as it would have been at the annual rate obtaining after the transition. The second term represents "excess" marriages. (If $p > 1$, there are more marriages after the transition than before and as equation (19) shows, marriages occur at an even higher rate in the transition period.) The term corresponding to "excess" marriages may be written

$$\int_l^L [N_1(x) - N_2(x)]dx$$

which is the formula previously obtained.

281. In practice, as has already been stated, the assumption which underlies this formula about the manner in which the transition from $N_1(x)$ to $p.N_1(x)$ takes place will not be fulfilled, but probably neither will the other assumption under which no " excess " marriages whatever occur. The course of events is likely to be intermediate between the two extremes and there will be some " excess " marriages. It may be particularly noted that this occurs if it is assumed that, as from a certain date, the new system of marriage-*rates* (defined as the probability of marriage for unmarried persons) comes into operation simultaneously for all age groups, i.e. all cohorts then in marriageable ages(1).

282. All these remarks apply to the case where the change in proportions married is such that the age at marriage is not changed(2). In practice, however, such a change is most unlikely to occur. A change in proportions married such that a greater proportion marry in each cohort is also likely to imply younger marriages. The two kinds of " excess " effect will, therefore, reinforce one another. All types of " excess " are covered by the more extended concept of excess introduced below.

Mortality introduced

283. We now proceed to remove the restrictive assumption that persons of marriageable age are not subject to mortality. In one sense, indeed, the argument developed so far is directly applicable if mortality is taken into account. The advantage of the assumption that mortality was nil was that in this case the number of persons living and married at age x is equal to the number of marriages occurring in the cohort in question before age x. It is the latter concept—the number of marriages occurring before age x—which enters into the argument. If therefore we reinterpret $BN(x)$ to mean the number of marriages of persons aged x or less, occurring among B births, the argument will hold. We can thus consider the change from a situation in which one set of marriage and mortality rates was in operation such that the number of marriages occurring before age x was $BN_1(x)$ to a situation in which the number of marriages occurring before age x is $BN_2(x)$. If the number of marriages in a cohort remains the same throughout, i.e. if $N(L)$ is constant throughout, then the number of excess marriages will be equal to the number of marriages normally occurring in the period of time by which the mean age at marriage has changed.

284. This form of treatment is, however, of limited usefulness, first because the concept of the number of marriages which have occurred in a generation is somewhat abstract and it is complicated to compute values of $N(x)$ in this sense for an actual population, and secondly because in this sense $N(x)$ would depend on mortality conditions and it is more useful to isolate the effect of changes in nuptiality. It is convenient, therefore, to adopt a somewhat different mode of treatment which serves greatly to extend the concept of " excess " marriages. It includes both types of " excess " marriages so far discussed (in paragraphs 262 to 275 and 276 to 281 respectively).

(1) It was this kind of " excess " effect in a concealed form, and as applied to births and not marriages, which C.E. Quensel discussed in his paper: " Changes in fertility following birth restriction ", *Skandinavisk Aktuarietidskrift*, 1939, p. 177.

(2) If " excess " does occur, marriages of the particular cohorts taking part in the transition will have a different distribution by age even if the change in the proportions married implies the same distribution by age at marriage [i.e. $N_2(x)=pN_1(x)$]. On the assumption made in para. 277, each cohort has the same distribution by age at marriage and no " excess " occurs.

An extended meaning of "excess" marriages

285. It will be assumed, as before, that the population is recruited from a constant number of births.

286. We shall assume that there is no difference between the mortality of single persons and general mortality(1), and that mortality is constant.

287. Let l_x denote the number of survivors at age x, the radix being taken as equal to the constant annual number of births assumed.

288. Let $N(x, t)$ denote the proportion married among persons aged x at time t. The number of married persons aged a at time t is therefore equal to $l_x N(x,t)$.

289. Let the number of marriages between time t and $(t+dt)$ of persons aged x at time t be denoted $M(x, t)$. $M(x, t)$ must be equal to that part of the change in the number of married persons which is due to change in $N(x, t)$.

Then we have

$$M(x, t) = l_x\left(\frac{\partial N}{\partial x}\,dx + \frac{\partial N}{\partial t}\,dt\right) \qquad \ldots \qquad \ldots \qquad (20)$$

290. If the proportions married were not changing over time, $\frac{\partial N}{\partial t}$ would be zero. Thus if the proportions married were to remain constant at $N(x, t)$ the number of marriages at each age would be $l_x \frac{\partial N}{\partial x}\,dx$. Under these conditions we may write $M(x)$ instead of $M(x, t)$ for the marriages of persons aged x and for the total number of marriages per year we should have

$$\int_l^L M(x)dx = \int_l^L l_x \frac{\partial N}{\partial x}\,dx \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (21)$$

291. To return to the case where the proportion married at age x changes in a period of years between time a and time b, let us write in accordance with the previous notation,

$$N(x, a) = N_1(x) \text{ and } N(x, b) = N_2(x) \qquad \ldots \qquad (22)$$

The total number of marriages of persons aged x occurring between a and b is

$$\int_a^b M(x, t)dt = \int_a^b l_x \frac{\partial N}{\partial x}\,dt + \int_a^b l_x \frac{\partial N}{\partial t}\,dt$$

$$= l_x \int_a^b \frac{\partial N}{\partial x}\,dt + l_x\,[N_2(x) - N_1(x)] \quad \ldots \quad (23)$$

---

(1) This assumption is not necessary for the results If allowance is to be made for the effect of marital status on mortality, l_x must be read as the number of survivors in the life table for single persons, and $l_x[1-N(x, t)]$ must be taken as the number remaining single at age x. Thus $N(x, t)$ may be regarded as the proportion married according to gross nuptiality, but it does not represent the proportion of single persons to all persons in the population discussed (which corresponds to the stationary population according to net nuptiality). If the symbols are interpreted in this sense, equation (20) holds and everything else follows.

292. The first term in this equation indicates how many marriages would have occurred between a and b if at each instant there had only been the number of marriages resulting from the permanent maintenance of the proportions married at that instant. The precise value of this term depends on the values which $N(x, t)$ takes between a and b. But the second term of this equation depends only on the values of $N_1(x)$, $N_2(x)$ and l_x It gives the total number of marriages occurring throughout the interval between a and b in excess of the number required to keep the proportions married constant at each instant. The total number of " excess " marriages in this sense occurring at all ages in the period of transition is

$$\int_l^L l_x \left[N_2(x) - N_1(x)\right] dx \qquad \ldots \quad \ldots \quad \ldots \quad (24)$$

293. In this " extended " sense there are always excess marriages when the proportions married change. However, this extended sense of excess marriages though convenient for analytic purposes does not necessarily correspond to commonsense notions. This may be seen by considering the special case in which the number of marriages per annum after time b is exactly the same as before time a, i.e.

$$\int_l^L l_x \, N_2(x) dx = \int_l^L l_x \, N_1(x) dx \qquad \ldots \quad \ldots \quad (25)$$

294. In such a case the change amounts to a change in the age at marriage only, and we may expect to have the same relationship as in the example previously given, i.e. the number of marriages temporarily rises above, (or falls below) the normal level to which it afterwards returns. In the commonsense meaning of the term the number of " excess " marriages occurring in the transition period would be the difference between the total number of marriages occurring in the period and that which would have occurred had marriages continued at the normal level. In the present example there is, however, no guarantee that the total number of marriages in the transition period will be the number which would " normally " have occurred plus the number given by equation (24). This would only be the case if $N(x, t)$ behaved in such a way throughout the transition period that the number of marriages given by the first term on the right hand side of equation (23) exactly equalled the normal number of marriages, i.e. if

$$\int_l^L l_x \frac{\partial N}{\partial x} \, dx = \int_l^L l_x \, N_1(x) dx$$

for all values of t, or at any rate that

$$\int_a^b \int_l^L l_x \frac{\partial N}{\partial x} \, dx dt = (b - a) \int_l^L l_x \, N_1(x) dx \qquad \ldots \quad (26)$$

295. These conditions are unlikely to be precisely fulfilled, but they are very likely to be approximately true. For

$$\int_l^L l_x \frac{\partial N}{\partial x} \, dx = l_L \, N(L, t) - \int_l^L l_x' N(x \;\, t) \, dx \qquad \ldots \quad (27)$$

296. The number of marriages of persons under age L is equal to the married survivors at age L plus the deaths of married persons under age L. Now death-rates at the relevant ages (taking L as, say, 50) are very low in England and demographically similar countries, and the last term on the right hand

side (the deaths of married persons) is fairly small (less than 10 per cent.)(1) of the total number of marriages. Fluctuations in this term due to changes in $N(x, t)$ must be insignificant particularly if we suppose that throughout the period of transition $N(x, t)$ is between $N_1(x)$ and $N_2(x)$, both of which result in the same number of marriages. If this supposition did not hold it would in any case be more natural to speak not of one transition from $N_1(x)$ to $N_2(x)$, but of several distinct changes. The more important term in equation (27) is however $l_L N(L, t)$. Now the proportions ultimately married certainly do not change much in the short run in any case and if $N_1(L) \lesssim N(L, t) \lesssim N_2(L)$ throughout the period of transition, the condition expressed in equation (26) must be approximately fulfilled.

297. If we consider a case in which after the change the number of marriages does not return to its previous level, i.e. if the condition expressed in equation (27) is not fulfilled, it can be shown by arguments analogous to those advanced in paras. 274–5, that changes in proportions married such as actually occur are very likely to produce a substantial real excess (or deficit) of marriages.

298. In connection with the " extended " sense of excess marriages another qualification must be discussed. In accordance with equation (23) the excess marriages can be distributed by age, the number occurring at age x being $l_x [N_2(x) - N_1(x)]$. In any ordinary sense, the excess marriages cannot be distributed by age. This problem, however, raises the question of the appropriate limits for integration in equation (24). So far as the argument is concerned, there is no reason why the limits in equations (24) should not be wider than l and L or even be 0 and ∞. The substitution of 0 for l does not alter the number of excess marriages, but the extension of the upper limit beyond the highest age (L) at which marriages occur, may, paradoxically, alter the number of excess marriages. Consider a population in which no one marries over, say, age 50 and suppose that in such a population marriage habits change in such a way that of those reaching age 50, 95 per cent. have married after the change as against 85 per cent. before the change. Application of formula (24) will then yield the result that in the transition period there were, at every age over 50,

$$l_x (0 \cdot 95 - 0 \cdot 85)$$

" excess " marriages. In fact there were no marriages at all of persons over 50. The reason why excess marriages in the extended sense occur in spite of this was referred to above. The assumptions made imply that at some stage in the transition period, a greater proportion should be married among those aged 50 than among those aged 60. Thus, to maintain this situation permanently a negative number of marriages would have to occur between ages 50 and 60—i.e. the first term of equation (23) would be negative. Since, however, the number of marriages was zero it was greater (in the algebraical sense) than it would have been if it had been such as to maintain the proportions married obtaining at the time. There is, of course, a real significance in the fact that if the limits of integration are extended the number of " excess " marriages is increased. For it takes a greater number of excess marriages to alter the proportions married among a greater number of persons.

(1) cf. J. Hajnal, " Some Aspects of Recent Trends in Marriage in England and Wales " *Population Studies*, Vol. I No. 1, June 1947, Tables 6 and 7. According to 1938 female marriage rates and 1938–9 female mortality there would be 803 married survivors at age 50 out of 1,000 at age 16. On the other hand there would be 879 marriages before age 50. The number of deaths of females after marriage is therefore 879−803=76 and this represents 8·6 per cent. of the 879 marriages.

299. In order to limit consideration to marriages relevant to fertility, an age limit of 45 is used below for practical purposes.

300. A calculation of the number of excess marriages in accordance with formula (24) is illustrated in Table 34 below. The proportions married used are those recorded for women in England and Wales in 1932 and 1946. The life table relates to 1938–9 mortality. Since the proportion married in the oldest age groups did not change very much, the total number of marriages occurring before and after the change must be roughly the same. In a population recruited from 1,000 births a year it must be about 900 × 0·82 = 738. The excess marriages are therefore roughly equal to the total of marriages normally taking place in 2·9 years.

TABLE 34

"Excess Marriages", England and Wales, 1932–1946

(1)	(2)	(3)	(4)	(5)	(6)
Age group	Proportion of women married at end of 1932	Proportion of women married at end of 1946	Column (3) minus Column (2)	Stationary population according to 1938–39 mortality of women	Product of Column (4) and Column (5)
15–19 ...	·021	037	·016	4,624	74
20–24	·262	442	180	4,578	824
25–29	·589	746	157	4,525	710
30–34	·748	825	077	4,468	344
35–39	796	831	035	4,405	154
40–44 ...	·818	825	·007	4,328	30
Total					2,136

Effect on Reproduction Rates[1]

301. In a hypothetical population (such as that which has been considered) in which the number of women aged x is equal to l_x, the net reproduction rate is obviously equal to the number of female births divided by the radix of the life table. It follows that if as a result of changes in the proportions of women married, the number of marriages temporarily rises (or falls) and if fertility rates specific by duration of marriage are constant the N.R.R. will temporarily rise and then fall again (or vice versa). As a result of changes in proportions of women married, the distribution of the married women by ages and duration of marriage will be abnormal.

302. The total temporary addition to births and, therefore, to reproduction rates will be given by the births to the "excess" marriages. If the normal number of marriages after the change in marriage proportions is the same as it was before, the N.R.R. will ultimately return to its original level when the excess marriages no longer affect the number of births. If the number of marriages normally occurring is altered by the change in the proportions married, the births to the "excess" marriages in the extended sense may be used to measure the effect of the "excess" marriages on reproduction rates. This "excess" must then be interpreted as the excess of the reproduction rate over what the reproduction rate would have been if at each moment of time

[1] The statements in this section are in terms of the traditional female N.R.R.'s and the proportions of women married. They apply equally to male N.R.R.'s and proportions married among men.

a reproduction rate were computed to measure the replacement of a generation of women who marry at the rates required to keep constant the proportions married of that moment.

303. A hypothetical population recruited from a constant number of births is, however, also useful for envisaging the effect in an actual population of a change in the proportions of women married on the N.R.R. In the computation of the N.R.R., the fertility rate at each age is weighted in accordance with the age distribution of the stationary population. Therefore, in a real population the effect on the N.R.R. of a change in the proportions married is the same as the effect which the same change would have on the number of births in a hypothetical stationary population.

304. This method may be used to study the effect on the N.R.R. of a change in proportions married such as that which occurred in England and Wales between 1932 and 1946. If there were no illegitimate births, mortality were constant at the level of 1938–39 and the fertility rates of all marriages under 45 were constant and equal for all ages at marriage, the temporary addition to the births of the stationary population would correspond to the number of "excess" marriages, i.e. it would be about 2·9 times the normal annual number. Since the change in the proportions married took place over a period of 14 years, we may suppose that the births to the "excess marriages" would mainly occur within a period of 30 years (the fertility of marriages of over 15 years' duration is very low). Under these assumptions, the N.R.R. would have been raised by an average of about 10 per cent. over the normal level in those 30 years. Other things being equal, therefore, the changes in proportions married which have occurred in the recent past must cause considerable temporary fluctuations in the N.R.R.

The general case

305. In an actual population the number of persons at any age is influenced by the past history of births and past changes in mortality and migration. Removing all restrictive assumptions we may denote by $A\ (x, t)$ the number of persons in the population who are aged x at time t. Then we have for the number of marriages of persons aged x at time t:

$$M(x, t) = A(x, t) \left[\frac{\partial N}{\partial x}\, dx + \frac{\partial N}{\partial t}\, dt\right] \quad \ldots \quad \ldots \quad (28)$$

which is the same as equation (20) except that $A\ (x, t)$ takes the place of l_x. In analogy with the previous argument we have for the total of "excess" marriages (in the extended sense) of persons aged x

$$\int_a^b A\ (x, t) \frac{\partial N}{\partial t}\, dt \quad \ldots \quad \ldots \quad \ldots \quad (29)$$

306. This expression cannot be evaluated without knowledge of the precise changes occurring in $A\ (x, t)$ and $N\ (x, t)$. But if a and b lie sufficiently close together we have approximately

$$\int_a^b A(x, t)\, \frac{\partial N}{\partial t}\, dt \approx \frac{N_2(x) - N_1(x)}{b - a} \int_a^b A(x, t) dt \quad \ldots \quad (30)$$

307. It is always possible to split up a time interval into portions sufficiently small to make the approximation given in (30) adequate. The calculation is illustrated below for England and Wales in the period 1933–46. The first period considered separately is 1933–35. The figures in column (5) are one-third of the sum of the mid-year population estimates of the years 1933, 1934 and 1935. It will be seen that the total of "excess" marriages in these three years was 68,000. Carrying out a similar calculation for the periods 1936–39, 1939–42 and 1942–46, we obtain "excess" marriages amounting (in thousands) to 203, 395 and 134 respectively. During the four periods considered the number of marriages under 45 (in thousands) were 944, 1,003, 1,548 and 1,229 respectively. There were thus in the period of 14 years, 1933–1946, altogether 4,724,000 marriages of spinsters under 45. Of these, 800,000 were "excess" marriages. The remaining 3,924,000 give an average of 280,000 per annum. The number of "excess" marriages was therefore almost 2·9 times the mean "normal" annual number. This figure agrees with the figure obtained above in para. 300 where the same proportions married were applied to a life table population.

TABLE 35

Number of "Excess Marriages", England and Wales, 1933–35

(1)	(2)	(3)	(4)	(5)	(6)
Age group	Proportion of women married at end of 1932	Proportion of women married at end of 1935	Col (3) minus Col. (2)	Mean population in years 1933–35 (000's)	Product of Col (4) and Col. (5)
15–19 ..	·021	023	·002	1,532	3
20–24	262	281	·019	1,762	34
25–29	·589	·610	021	1,778	37
30–34	·748	·741	—·007	1,685	−12
35–39 . .	·796	800	·004	1,561	6
40–44	·818	·818	—	1,465	—
Total ..					68

308. It will be recalled that it was shown above (paras. 258–9) that if the proportions married given by 1938 nuptiality had obtained in 1932 and been maintained throughout the period there would have been 4,166 thousand marriages of spinsters under 45. The actual number of marriages exceeded this figure by 4,724 — 4,166 = 558 thousand.

The Two Sexes

309. The discussion in this chapter and the illustrative calculations have been in terms of one sex only. Though the numbers of men and women marrying must of necessity be the same, the proportion of marriages which represents "excess" may differ between the two sexes. As here defined, the conception of "excess" marriages applies to first marriages, and it is possible for the proportion of first marriages among the marriages of one sex to change in a different amount from that of the other. The ages at marriage may change differently in the two sexes if the distribution of the difference between the ages of bride and bridegroom changes. The possibility which has by far the greatest practical importance, however, is a change in the supply of women relative to that of men. It is this factor (described in Chapter II) which in recent years has caused a far greater change in the proportions married among women than among men. The number of "excess" marriages was thus greater when measured by the proportions married among women than when measured by the proportions married among m

CHAPTER X—SOME FURTHER APPLICATIONS

Changes in Mortality

310. As has been mentioned before, the analysis in the last chapter may be applied to other "stock-flow" relationships, i.e., other instances of the "displacement" of events over the life cycle of cohorts. The clearest case is presented by deaths. As everyone must die, all changes in death rates are only changes in the age at death. Once the number of births is determined, the number of deaths is also determined (apart from the effects of migration). A fall in death rates will cause a fall in the number of deaths followed by a subsequent rise.(1)

311. It is this effect which accounts for the fact that in England and Wales the number of deaths has on average been below 500,000 for two decades while the number of births has been over 600,000 for over 100 years, and was over 800,000 for a large part of the period most relevant to the deaths now occurring. (Up to 1931 net migration was of course outward but this can only account for a small part of the differences between the numbers of births and deaths). The negative "excess" of deaths could be evaluated by applying the formulae here developed. This could be done if the proportions of survivors as given by "generation life tables" were treated as analogous to proportions married.

Effect of changes in length of generation

312. The analysis presented in the last chapter may equally be applied to family size and fertility rates. This application is particularly important because it is mainly through their influence on births that "excess" effects influence the movement of population in the long run. One point only will be discussed here: the connection between a change in the mean length of the generation and an "excess" of births.

313. For analysing the effect of excess births various concepts may be used. For example, in analogy with proportions married, one could use the "stock" of births, i.e. the mean number of births to persons of various ages. For the present simplified treatment we may use the rates traditionally denoted by $\phi(x)$, i.e. the net probability that a new-born child will have offspring of the same sex x years after its birth. For the present purpose let $\phi(r, t)$ denote the probability that a child born at time t will have offspring of the same sex r years later. Then the function

$$D(x, t) = \int_0^x \phi(r, t)\, dr$$

may be regarded as analogous to $N(x, t)$. Let

$$T = \int_0^{\omega} r\, \phi(r, t)\, dr$$

be the mean length of a generation, ω being the highest age at parenthood.(2)

(1) If death rates fall at the young ages and the number of births is increased, the ultimate effect must be to increase the number of deaths above that which would have occurred had mortality remained constant.

(2) The present discussion is in terms of one sex only, like the traditional treatment of the N.R.R. Alternatively, this discussion may be looked upon as applying to the case where the age of the father and the age of the mother of each child are equal. This way of looking at the matter shows more clearly the kind of extension which would have to be made to cover the more general case. Where $R_0 \neq 1$ the shift in the mean length of the generation cannot be the same for the paternal and maternal generation and it is impossible that after the change both the paternal and maternal reproduction rates should remain as before.

314. We shall use the theorem that, if an original number of births, say H, occurring at time 0, produce offspring at rates $\phi(x)$ which are constant over time, and if $B(t)$ denotes the number of their offspring at time t we may write if t is large(1):

$$B(t) = \frac{H}{T}(R_0)^{\frac{t}{T}} \text{ where } R_0 = \int_0^\omega \phi(x)dx \quad .. \quad (31)$$

315. We may now consider a number of special cases:

(1) Let the numbers of births per annum in a population be constant, say B. Thus $R_0 = 1$.

Now consider a change in fertility rates(2) implying a change from $D_1(x)$ to $D_2(x)$. We shall assume that R_0 remains unaltered at unity, i.e. that $D_1(\omega) = D_2(\omega) = R_0 = 1$. We shall further assume that throughout the transition period $D(\omega)$ remains constant at 1, i.e. that each cohort of births in fact completely reproduces itself(3). The mean length of a generation is, however, altered from T_1 to T_2. This case is precisely analogous to the first hypothetical example considered above in which it was assumed that no deaths occurred among persons of marriageable age. The number of persons of each generation who married remained constant, but only the age at marriage changed. From equation (10) it may be seen that the number of " excess " births occurring in the transition period is

$$B(T_1 - T_2) \quad .. \quad .. \quad .. \quad (32)$$

(1) See, e g E. C Rhodes, " Population Mathematics, I ", *Journal of the Royal Statistical Society*, 1940, page 73.

(2) The change may be due to a change in the age at marriage or to other causes.

(3) It is this requirement which shows the necessity of introducing the function $D(x, t)$. The " excess " effect is essentially a cohort effect. If a change in the mean length of a generation is analysed in the traditional manner simply in terms of a change from fertility rates $\phi_1(x)$ to $\phi_2(x)$ it is easy to miss the " excess " effect. If we suppose that the new set of fertility rates comes into operation at one point of time for all age groups, there will obviously be no " excess " births, since the births in the past have been constant and the sum of each set of fertility rates is constant. This process will, however, mean that all those cohorts which are in process of bearing children at the time when the change takes place will have more (or fewer) children than are needed to reproduce themselves. Consider, for example, a generation aged a when the change takes place and suppose that

$$\int_0^a \phi_1(x)\,dx = D_1(\alpha)$$

Then

$$\int_a^\infty \phi_1(x)\,dx = 1 - D_1(\alpha)$$

and let

$$\int_0^a \phi_2(x)\,dx = D_2(\alpha)$$

and therefore

$$\int_a^\infty \phi_2(x)\,dx = 1 - D_2(\alpha)$$

Then the cohort in question after having had children in accordance with ϕ_1 up to age a will have had $D_1(a)$ births up to the time of the change. After the change, it will have $1 - D_2(a)$ births. The total number of births produced by this cohort in the course of its existence would be $(D_1(a) + 1 - D_2(a))$ and this cannot equal 1, since $D_1(a) \neq D_2(a)$.

The easiest way for the assumption in the text above to be fulfilled is for all persons born up to a certain point to experience throughout their lives the rates $\phi_1(x)$, and then for persons born after a certain time to have births at the rates $\phi_2(x)$.

From equation (31) it will be seen that eventually this number of births wi give rise to a steady annual number of births equal to

$$\frac{B}{T_2}(T_1 - T_2) \quad .. \quad .. \quad .. \quad .. \quad (33$$

Since the original number of births per annum was B, the eventual tot number of births after the change in the age at marriage will be

$$B_2 = B_1 + B_1\left[\frac{T_1}{T_2} - 1\right] = B_1\frac{T_1}{T_2} \quad .. \quad (34$$

The same result might be reached by regarding the original annual numbe of marriages as equivalent, in accordance with equation (31) to a certain numbe of births (H) concentrated at one point; where

$$H = B_1 T_1 \quad .. \quad .. \quad .. \quad .. \quad (35$$

But if the mean length of a generation were T_2, the same number of birth (H) would produce an annual total of births equal to

$$B_1\frac{T_1}{T_2} = B_2 \; ...... \text{ which is the equation (34)}$$

316. (2) Suppose that a certain population is increasing or decreasing at geometric rate $R_0 \neq 1$. Then suddenly between time a and time b fertilit rates change in such a way that R_0 remains what it was but the mean lengt of a generation changes from T_1 to T_2. We shall again suppose that eac cohort in the transition period actually produces R_0 births.

317. Such a change has two different effects. It results in the first instance i an "excess" (negative or positive) of births. If after the change, the ne rates remain constant for each age, the rate of growth in the number c births will again approach a limit. But the new rate of growth will be differer from the old one. This effect on the ultimate rate of growth must be considere separately from the initial effect of an "excess" in births. There are fou cases to be distinguished according to whether $T_1 \gtrless T_2$ and $R_0 \gtrless 1$.

318. (*a*) Suppose first that there is a decline in the mean length of the generatior i.e. that $T_1 > T_2$. Then the "excess" of births is positive and the populatio will for a time be greater than it would have been had no change occurrec If $R_0 > 1$, the rate of growth of the number of births is positive and the ne ultimate rate of growth will be greater than the old one, since $T_1 > T_2$.] on the other hand $R_0 < 1$, the population will still be greater for a while tha it would have been had no change occurred. But the ultimate rate of declin will also be greater than it would have been had no change occurred. In th long run therefore the number of births will as a result of the change fall belo that which would otherwise have occurred, in spite of the initial increase du to the "excess" births.

319. (*b*) If $T_1 < T_2$ the situation is the reverse of that just described. The initi effect will be a reduction in the number of births. If $R_0 > 1$, the ultimat effect of a reduced rate of increase will reinforce the initial reduction in th number of births. The number of births will always be lower than it woul have been had no change occurred. If $R_0 < 1$, the reduction in the ultimat rate of decline will mean that in spite of the initial reduction in the numbe of births, births will eventually be higher than they would have been had n change occurred.

320. The fact that changes in the age at marriage have had so profound an effect on the number of marriages, and therefore the number of births, in the recent past, makes it important to consider the effect of possible future changes in the age at marriage on the number of births. The customary technique of population projection fails in two respects to take account adequately of the possible effect of changes in the age at marriage. In the first place it fails to consider the possible increase or decrease, resulting from such a change, in the number of births born to a cohort of men or women in the course of their lives. It would of course be possible to allow for this effect by increasing the customary age-specific fertility rates used, but only explicit calculations based on marriage rates or proportions married can show just what allowance it is reasonable to make. Secondly, the possible effect of changes in the age at marriage makes it important to consider a type of movement in the future number of births which would not occur to the mind of anyone engaged upon projections by customary technique. For, as has been shown, the effect of changes in the age at marriage is temporarily to decrease or increase by a very considerable amount the age-specific fertility rates.

321. If we assume that changes in the size of family in the near future will be gradual, there may nevertheless be large variations in the number of legitimate births owing to changes in the age at marriage. The number of births is in any case likely to fall below the average level of the past 4 or 5 years because part of those births were due to making up of births postponed in previous years. The fall in the number of births may be accentuated by an increase in the age at marriage, or in other words a diminution in the proportions married at the young ages. Such a diminution occurred after the last war and may occur after this war, because the extraordinary marriage booms at the beginning of the war and again after its end were undoubtedly stimulated by circumstances connected with it. On the other hand there may be a further lowering of the age at marriage which would serve to postpone any large decrease in the number of births in the future. It is essential, for any discussion of the future of the population in the next two or three decades that is to be realistic, to take account of such possibilities.

322. Other factors besides changes in the age at marriage, for example "postponement" of births within marriages, have the same effect of "displacing" the time of occurrence of births over the life-span of successive cohorts. To take such effects into account in projections is, however, probably much more difficult than in the case of changes in proportions married.

NOTES ON COMPUTATION

NOTE I

LIFE TABLES

The 1938–39 life table, which is the basis of most of the computations in this paper, is given in Table A below(1). For the computation of nuptiality tables a life table according to the mortality of the single population is required. Under age 20, the mortality of the single was taken as identical with general mortality. The death rates of the single population are given in Table B below together with life table values based on them. Since the tabulation of the deaths of men by marital status was not available for the whole of 1938 the death rates of the single for 1938–39 were obtained by multiplying the general death rates for each age group in 1938–39 by the ratio of the death rate of the single in 1939 to the general death rate in 1939.

For certain computations, life table values based on the mortality experienced in 1945 by persons under 20 were used. For ages over 20, 1945 death rates were not used since only civilian death rates were available and these were higher even than the 1938–39 rates in many instances owing to the exclusion of non-civilians, who are a particularly healthy section of the population. The 1945 death rates and life table values are given in Table C below. The life table was calculated by the General Register Office.

TABLE A

Life Table, England and Wales, 1938–39

MALES

Age (x) (1)	Central death rate in age-group x to next age stated (per 1,000) (2)	Chance of surviving to next age stated (3)	Chance of surviving from birth to age stated (l_x) (4)	Years lived per 100,000 births between age x and next age stated (L_x) (Stationary Population) (5)
0	57·90(2)	·94210	1·00000	95,454
1	7·74	9922	·94210	93,842
2	3 82	·9961	·93475	93,292
3	2 95	9970	·93110	92,970
4	2 53	·9974	92831	92,710
5	1·79	9911	·92589	460,885
10	1·17	·9941	·91765	457,470
15	1·93	·9903	·91224	453,905
20	2·71	·9865	·90339	448,645
25	2·71	·9865	·89119	442,585
30	2·90	·9856	·87916	436,415
35	3 78	·9812	·86650	429,175
40	5·30	·9738	85021	419,535
45	8·02	·9606	·82793	405,805
50	12 71	·9384	·79530	385,400
55	18·94	·9095	·74631	356,270
60	29·05	·8646	·67877	316,407
65	44·03	·8016	·58686	264,325
70	70·92	·6988	·47043	199,789
75			·32874	213,595(3)

(1) This life table was calculated by Mr. W A. B Hopkin.
(2) Death rate per 1,000 live births.
(3) Years lived at ages 75 and over.

FEMALES

Age (x) (1)	Central death rate in age-group x to next age stated (per 1,000) (2)	Chance of surviving to next age stated (3)	Chance of surviving from birth to age stated (l_x) (4)	Years lived per 100,000 births between age x and next age stated (L_x) (Stationary Population) (5)
0	44·79(1)	95521	1 00000	96,501
1	6·78	·9932	·95521	95,196
2	3·36	·9966	·94871	94,709
3	2·57	9974	·94548	94,425
4	2 22	·9977	·94302	94,193
5	1·55	9922	·94085	468,590
10	1·03	·9948	·93351	465,540
15	1·68	9916	·92866	462,380
20	2·26	·9887	·92086	457,825
25	2·43	·9879	91045	452,470
30	2·56	9872	·89943	446,635
35	3·09	·9846	88792	440,540
40	4·00	9801	·87425	432,750
45	5 71	9718	·85685	422,385
50	8 34	9592	83269	407,852
55	12 14	·9410	·79872	387,580
60	19 48	9071	·75160	358,345
65	31·22	8552	·68178	316,210
70	52·04	·7697	·58306	257,960
75			·44878	348,266(2)

(1) Death rate per 1,000 live births.
(2) Years lived at ages 75 and over.

TABLE B

Life Table according to Mortality of Single, England and Wales, 1938–39

MALES

Age (x) (1)	Central death-rate in 5 year age group after age x (per 1,000) (2)	Chance of surviving 5 years (3)	Chance of surviving from birth to age stated (l_x) (4)	Years lived per 100,000 births between age x and $x + 5$ ($_5L_x$) (Stationary Population) (5)
0	—	·92589	1 00000	468,267
5	1·79	·9911	92589	460,885
10	1·17	·9941	·91765	457,473
15	1 93	·9903	·91224	453,908
20	2 98	·9852	·90339	448,353
25	3·83	9810	·89002	440,783
30	5·05	·9751	·87311	431,120
35	6·85	·9663	·85137	418,513
40	8·76	·9571	·82268	402,518
45	12·60	·9388	·78739	381,648
50	18·34	·9122	·73920	353,355
55	25·53	·8796	·67422	316,815
60	35·82	·8350	·59304	272,058
65	52·53	·7669	·49519	218,738
70	73·19	·6898	·37967	160,430
75	—	—	·26196	100,965
80	—	—	—	48,615
85	—	—	—	20,626(1)

(1) Years lived at ages 85 and over.

FEMALES

Age (x) (1)	Central death-rate in 5 year age group after age x (per 1,000) (2)	Chance of surviving 5 years (3)	Chance of surviving from birth to age stated (l_x) (4)	Years lived per 100,000 births between age x and $x + 5$ ($_5L_x$) (Stationary Population (5)
0	—	·94085	1·00000	475,023
5	1·55	·9922	·94085	468,590
10	1·03	·9948	·93351	465,543
15	1 68	·9916	·92866	462,380
20	2·32	·9885	·92086	457,783
25	2 70	·9866	91027	452,085
30	3 01	9851	·89807	445,690
35	3 68	·9817	88469	438,298
40	4 75	9765	·86850	429,148
45	6·47	·9681	·84809	417,283
50	9·11	·9554	·82104	401,365
55	12·55	·9390	·78442	380,248
60	18 74	9102	·73657	351,750
65	29 10	8639	67043	312,403
70	45·95	·7931	·57918	259,633
75	—	—	45935	188 273
80	—	—	—	109,252
85	—	—	—	58,943(1)

(1) Years lived at ages 85 and over.

TABLE C

Life Table for Civilians, England and Wales, 1945

MALES

Age (x) (1)	Central death rate in age-group x to next age stated (per 1,000) (2)	Chance of surviving to next age stated (3)	Chance of surviving from birth to age stated (l_x) (4)	Years lived per 100,000 births between age x and next age stated (L_x) (Stationary Population) (5)
0	51·42(1)	·94858	1·00000	94,896
1	4 46	·99555	94858	94,647
2	2 50	·99751	·94436	94,319
3	2·14	·99786	·94201	94,100
4	1·92	·99808	·94000	93,909
5	1·35	·99327	·93819	467,517
10	1·03	·99486	·93188	464,740
15	1·79	·99109	·92709	461,479
20	—	—	·91883	—

FEMALES

Age (x) (1)	Central death rate in age-group x to next age stated (per 1,000) (2)	Chance of surviving to next age stated (3)	Chance of surviving from birth to age stated (l_x) (4)	Years lived per 100,000 births between age x and next age stated (L_x) (Stationary Population) (5)
0	40·27(1)	·95973	1·00000	96,806
1	3·95	·99606	·95973	95,784
2	2 25	·99775	·95595	95,488
3	1 86	·99815	·95380	95,292
4	1 39	·99861	·95203	95,137
5	1·01	·99498	95071	474,161
10	0·79	·99606	·94594	472,036
15	1·38	99312	·94221	469,485
20	—	—	·93573	—

(1) Deaths per 1,000 ' related ' live births.

TABLE B

Remarriages in Stationary Population according to 1938 Nuptiality and 1938–39 Mortality (10,000 female births)

FEMALES

(1) Age Group	(2) Proportion single in group according to gross nuptiality	(3) Stationary Population according to Mortality of Single (l_0=10,000)	(4) Population of single Women (3) × (2)	(5) Stationary Population according to general Mortality (l_0=10,000)	(6) Ever-married women (5)–(4)	(7) Remarriage rate per 1,000 ever-married	(8) Remarriages in Stationary Population (6) × (7)	(9) 1st Marriages	(10) Total Marriages (8) + (9)
15–19	·97078	46,238	44,887	46,238	1,351	—	—	987	987
20–24	·65046	45,778	29,777	45,783	16,006	0 81	13	4,322	4,335
25–29	·28972	45,209	13,098	45,247	32,149	1 68	54	2,020	2,074
30–34	·16549	44,569	7,376	44,684	37,308	2 33	87	493	580
35–39	·13037	43,830	5,714	44,054	38,340	2·61	100	189	289
40–44	·11545	42,915	4,955	43,275	38,320	2·41	92	83	175
45–49	·10803	41,728	4,508	42,239	37,731	2 24	85	48	133
50–54	10360	40,137	4,158	40,785	36,627	1·90	70	26	96
55–59	·10123	38,025	3,849	38,758	34,909	1·45	51	14	65
60–64	·09976	35,175	3,509	35,835	32,326	1·15	37	8	45
65–69	·09877	31,240	3,086	31,621	28,535	1 12	32	6	38
70–74	·09819	25,963	2,549	25,796	23,247	0 66	15	1	16
75–79	09804	18,827	1,846	18,394	16,548	0 28	5	—	5
80–84	·09804	10,925	1,071	10,674	9,603	0 11	1	—	1
							642	8,197	8,839

Notes to Table B

Column (2) was derived for ages under 55 from the single-year calculation referred to in the article quoted. Above age 55 they simply represent the means of successive figures in Column (4) of Table A.

Column (7) represents the number of marriages of widowed and divorced women in 1938 related to the number of married, widowed and divorced women in 1938, cases where the age was not stated having been rateably redistributed. Since the marriages of divorced persons over 45 are only tabulated in 10-year age groups in England and Wales, the numbers of such marriages in the age groups 45–54, 55–64 were somewhat arbitrarily divided between the 5-year age groups.

It will be seen that, to carry out on these lines a complete calculation of the number of marriages in a stationary population, five types of data are required: (*a*) a life table based on general mortality; (*b*) a life table based on the mortality of the single population; (*c*) the proportion of persons single, according to gross nuptiality, at the end of each age period [column (4) of Table A—the information in column (2) or column (3) of Table A is of course equally good since column (4) may be derived from either]; (*d*) the proportion of persons single according to gross nuptiality within each age period (column (2) of Table B); (*e*) rates of re-marriage (column (7) of Table B).

In all calculations in the present paper, items (*a*), (*b*) and (*e*) have been kept constant. It remains to describe the computation of (*c*) and (*d*). To obtain the distribution of marriages in a stationary population which would result from the maintenance of given proportions ever-married, the procedure illustrated in Table C was adopted. This procedure assures that the proportions single according to gross nuptiality are such as with the mortality assumed would result in the proportions ever-married on which the calculation is based.

Column (3) of Table C is the ratio of column (3) in Table A of Note I to column (5) in Table B of the same Note.

The figures in column (4) of Table C are used as the proportions single according to gross nuptiality—item (*d*) above—in the computation of marriages in the stationary population. Columns (5)–(9) of Table C show the method of interpolating these values to the end point of each age group. The figures in column (9) provide item (*c*) listed above for the computation of marriages in the stationary population.

The figures in this paper relating to the nuptiality of 1942–47 and 1938–43 (for women) were calculated from the change in proportions single occurring in each of these 5-year periods. The method is based on the consideration that those who were aged 15–19 in 1942 were aged 20–24 in 1947 and similarly for the other age groups.

The first six columns of Table D follow the lines of Table C. Column (7) is obtained by dividing each figure in column (6) by the figure occurring in the previous row in column (4). Column (8), which consists of the cumulative product of the figures in column (7), gives the proportion single according to gross nuptiality (item (*d*) above) within each age group. By means of the interpolation process illustrated in columns (5) to (9) of Table C, the proportion single at the end of each age group (item (*c*)) is obtained. The marriages in the stationary population are then calculated as in Tables A and B.

TABLE C

Calculation of nuptiality table from proportions single among women in 1938

Age Group (1)	Proportion of women single in 1938 (2)	Ratio of Survivors according to general mortality to Survivors according to mortality of single (3)	Product of Columns (2) & (3) (4)	Proportion single according to 1938 gross nuptiality (5)	Ratio of Column (4) to Column (5) (6)	Mean of successive values in Column (6) (7)	Proportion single at end of age group according to 1938 gross nuptiality (8)	Product of Columns (7) and (8) (9)
15–19 ...	978	1·0000	·978	·97078	1 00744	1 02259	·89310	91328
20–24 ..	·675	1·0001	675	·65046	1·03773	1·12462	·42110	47358
25–29 ...	·351	1·0009	·351	·28972	1 21151	1·36713	19765	27021
30–34 ...	·251	1·0026	·252	·16549	1 52275	1 52843	·14233	·21754
35–39 ..	·199	1·0051	·200	·13037	1 53410	1·55527	12074	18778
40–44 ...	·180	1·0084	182	·11545	1 57644	1 58893	·11109	17651
45–49 ..	·171	1·0122	·173	·10803	1 60141	1·58739	·10533	·16720
50–54 ..	·160	1·0162	·163	·10360	1·57336	1·57202	·10215	16058
55–59 ..	·156	1·0193	·159	·10123	1 57068	1·58226	·10030	·15870
60–64 ...	·156	1·0187	·159	·09976	1·59383	—	—	—

TABLE D

Calculation of gross nuptiality corresponding to change in proportions single among women between 1942 and 1947

Age Group (1)	Proportion of women single in 1942 (2)	Ratio of survivors according to general mortality to survivors according to mortality of single (3)	Product of Columns (2) & (3) (4)	Proportion of women single in 1947 (5)	Product of Columns (3) & (5) (6)	Probability of remaining unmarried from one age period to the next (7)	Cumulative product of figures in Column (7) (8)
15–19	·96076	1·0000	·96076	·96322	·96322	·96322	·96322
20–24 .	·57596	1·0001	·57602	·55159	·55165	57418	·55306
25–29 . .	27033	1·0009	·27057	·24498	·24520	·42568	23543
30–34 ...	20680	1 0026	·20734	17210	·17255	·63773	·15014
35–39 .	19627	1·0051	·19727	·16456	16540	·79772	11977
40–44 ...	17421	1·0084	·17567	17435	·17581	·89122	·10674
45–49 . .	16858	1·0122	·17064	·16281	·16480	·93812	·10013
50–54 ...	·16096	1 0162	·16357	·15649	15903	93196	·09332
55–59 . .	·15610	1·0193	15911	15355	·15651	95684	·08929
60–64 ...	·15480	1 0187	·15769	·15463	·15752	·99001	·08840

Tables E and F below set out the data on gross nuptiality used in the various calculations of the distribution of marriages in the stationary population. Table E gives the probability of marrying within 5 years after reaching each age (i.e., figures corresponding to those in column (2) of Table A). Table F gives the proportion married within each age group according to gross nuptiality. For the calculations based on proportions married actually recorded, Table F gives the form corresponding to gross nuptiality, i.e., as in column (4) of Table C.

TABLE E

"Gross" Probability of marrying within 5 years of reaching stated age

MALES

Age	1938 Nuptiality	1938 Proportions single	1942–47 Nuptiality	1947 Proportions single
15 ...	·0159	·0176	·0457	0458
20 ...	·3650	·3314	·3749	3761
25 ...	·5886	·5456	5546	·5695
30 ...	·4603	·4062	·4234	·4453
35 ...	·2883	·2633	·3016	·2701
40 ...	·1704	·1696	·2075	—
45 ...	·1104	—	·1226	—
50 ...	·0635	—	·0390	—
55 ...	0388	—	·0336	—
60 ...	·0247	—	0333	—
65 ...	0153	—	—	—
70 ...	·0110	—	—	—
75 ...	·0045	—	—	—

FEMALES

Age	1938 Nuptiality	1938 Proportions single	1942–47 Nuptiality	1947 Proportions single
15 ...	·1069	·0867	·1772	·1781
20 ...	·5285	·4815	·5745	·5660
25 ...	·5306	·4294	·5144	·4778
30 ...	·2799	·1949	·2359	—
35 ...	·1517	·1368	·1432	—
40 ...	·0799	·0600	·0764	—
45 ...	·0519	·0527	·0632	—
50 ...	·0302	—	·0540	—
55 ...	·0181	—	·0263	—
60 ...	0108	—	·0180	—
65 ...	·0092	—	—	—
70 ...	0024	—	—	—
75 ...	·0006	—	—	—

TABLE F

Proportion single (gross)

MALES

Age Group	1938 Nuptiality	1938 Proportions single	1942–47 Nuptiality	1947 Proportions single
15–19	·9973	·994	·9918	·992
20–24	8321	·832	·7863	·786
25–29	4163	·459	·4015	·400
30–34	·1878	·229	·2071	·194
35–39	·1161	·155	·1284	·118
40–44	·0894	·117	·0949	—
45–49	·0770	—	·0777	—
50–54	0704	—	·0727	—
55–59	·0669	—	·0710	—
60–64	·0648	—	·0679	—
65–69	·0635	—	—	—
70–74	0627	—	—	—
75–79	·0622	—	—	—
80–84	·0622	—	—	—

FEMALES

Age Group	1938 Nuptiality	1938 Proportions single	1942–47 Nuptiality	1947 Proportions single
15–19	·9708	·978	·9632	·963
20–24	·6505	·675	·5531	·552
25–29	·2897	·351	·2354	·245
30–34	·1655	·252	·1501	—
35–39	·1304	·200	·1198	—
40–44	·1155	·182	·1067	—
45–49	·1080	·173	·1001	—
50–54	·1036	—	·0933	—
55–59	·1012	—	·0893	—
60–64	·0998	—	·0884	—
65–69	·0988	—	—	—
70–74	·0982	—	—	—
75–79	·0980	—	—	—
80–84	·0980	—	—	—

NOTE III

Fertility of Marriage by Age of Wife(1)

The material for a proper analysis of fertility rates by duration of marriage and the wife's age at marriage in England and Wales is not available. The tabulation of birth statistics is carried out in terms of age (last birthday) of mother at *maternity* and duration of marriage. The classification of age at maternity is by single years up to age 50, but the classification of duration of marriage gives only 5 year groups for marriages which have lasted 10 years or more. The population to which the maternities can be related has so far been estimated by a duration grouping which gives single years only up to 10 years of marriage and then one category " 10 years or over ".(2)

The table of rates derived from this material for 1944 (after rateably redistributing the maternities in respect of which the age or duration of marriage had not been stated(3) is shown below. Similar tables were available for all the years 1939–44 except that for 1939 the last duration category was " 9 years and over ".

The rates in the first few diagonals of the table, which relate to marriages in which the bride was under 21 at marriage, are liable to a special source of inaccuracy. There are probably a number of persons marrying at these young ages who do not state their age or do not state it correctly. The populations on which the rates in the first few diagonal lines are based are therefore probably underestimated. On the other hand at the registration of a birth the same reason for concealing the age of the mother does not apply (at any rate to the same extent) and the number of maternities on which the rates are based are probably not understated to the same extent. The rates are therefore too high.

In computing from this material reproduction rates taking specific account of marriage duration by method (1) referred to in para. 129, it is necessary to add together the married women at each age in the stationary population who have married 10 years or more and apply to them the fertility rate for marriage durations " 10 or over ".(4) This procedure implies the assumption that the fertility of women married " 10 years or more " varies only with the age at maternity but not with the duration of marriage. The error cannot be serious, but the method slightly exaggerates the effect of lowering the age at marriage upon reproduction rates since it assumes that the fertility rates of women of a given age married over 10 years would not be lowered in a population in which they have been married longer than in the actual population.

In working out values of the fertility of marriage by age of wife for use in the reproduction rate calculations of this paper, this assumption was explicitly made. As a first step, the rates in Table A were added along the diagonals.

(1) The calculations described in this note were originally carried out with a view to a fuller examination of the variation of fertility rates with age at marriage than is included in the report. The purposes of the present report would have been served equally well by less elaborate computations.

(2) For the method by which these population estimates are made, see the *Registrar General's Statistical Review of England and Wales, 1938, Tables Part II, Civil* (1944 edition), pp. 203 sqq.

(3) Since for the years 1939 and 1940 the tabulations by duration of marriage relate to maternities registered, the rates for these years were also multiplied by the ratio of the number of legitimate maternities occurring to the number of legitimate maternities registered.

(4) In fact it is also advisable to use 5-year age groups. The rates cannot be relied upon in the full detail given in the Table. This detail has been shown only to present in full the method of calculation here used.

TABLE A

Legitimate Maternity Occurrence Rates 1944

(per 1000 married women

Age Group	Duration of Marriage (completed years)											
	All Durations	0	1	2	3	4	5	6	7	8	9	10 and over
16	611	601	—	—	—	—	—	—	—	—	—	—
17	425	459	249	—	—	—	—	—	—	—	—	-
18	351	363	320	306	—	—	—	—	—	—	—	-
19	303	306	307	269	247	—	—	—	—	—	—	-
20	279	266	310	256	255	260	—	—	—	—	—	-
21	262	250	306	227	239	261	282	—	—	—	—	-
22	237	237	287	216	205	211	210	267	—	—	—	-
23	218	233	260	208	199	196	201	197	300	—	—	-
24	204	236	262	196	181	194	183	175	210	258	—	-
25	197	235	259	198	176	191	175	172	192	211	264	-
26	190	237	256	193	173	183	173	176	170	182	218	54
27	176	214	245	190	168	172	167	158	162	161	163	25
28	169	219	252	188	170	168	166	144	150	157	150	19
29	162	219	242	184	164	160	169	150	147	146	146	158
30	152	221	242	191	162	164	159	146	140	129	125	142
31	135	201	221	172	146	153	149	137	130	120	109	120
32	133	211	225	172	147	152	153	134	136	123	115	117
33	121	200	217	167	148	140	144	129	128	115	109	105
34	111	189	212	159	141	136	136	123	121	114	104	96
35	101	154	199	143	145	144	133	119	116	108	98	86
36	91	170	184	138	123	134	126	115	110	100	88	77
37	76	144	168	120	113	127	105	102	97	88	81	66
38	68	137	157	115	104	107	112	91	96	81	72	59
39	56	113	123	98	85	92	97	83	77	73	60	50
40	42	86	97	90	65	67	64	69	58	56	46	38
41	30	82	72	53	55	50	40	42	42	28	36	27
42	24	59	59	44	42	38	37	37	32	27	27	22
43	16	40	39	29	30	27	22	21	18	24	17	15
44	9	16	19	17	14	18	9	14	16	14	11	8
				Summary in 5-year Age Groups								
16–19	328	343	308	277	258	—	—	—	—	—	—	—
20–24	229	244	282	212	198	200	193	186	229	295	—	—
25–29	177	226	252	192	171	175	169	156	156	157	154	180
30–34	130	206	226	175	151	152	150	136	132	121	112	109
35–39	78	146	170	125	118	126	119	106	104	94	83	66
40–44	24	58	59	49	44	43	37	40	37	33	31	15
45–49	2	8	4	5	3	2	3	2	2	3	2	2

These rates relate to women married at the same age. For example, the women who were at marriage duration ' 0 ' at age 17, and at marriage duration ' 1 ' at age 18, duration ' 2 ' at 19 etc., must all have been married after their 16th and before their 18th birthday. Their " central " age at marriage is thus 17. The rates were added in groups of 5 years of marriage duration. The result

s shown in Table B(1). For marriage durations of 10 years or more the igures were obtained in accordance with the assumption explained above Thus the total of rates of marriages of women aged 17 at duration '10–14 was taken as the total fertility(2) of women aged 27–31 and married 10 year or more (258 + 193 + 158 + 142 + 120 = 871). The final figure on the right of each row was computed as though the fertility rate for each year o each group between 45–49 was equal to the mean of the 5-year age group a given at the bottom of Table A.

TABLE B

Total of fertility rates in 1944 in 5 year groups of marriage duration by age at marriage

Central age at marriage	Marriage Duration							Total	Total under 10 yrs.	Total over 10 yrs.
	0–4	5–9	10–14	15–19	20–24	25–29	Over 30			
17	1,564	1,046	871	481	240	49	6	4,257	2,610	1,647
18	1,376	913	730	430	196	29	4	3,678	2,289	1,389
19	1.244	836	642	384	152	16	2	3,276	2,080	1,196
20	1,181	816	580	338	110	10	—	3,035	1,997	1,038
21	1,117	752	524	290	74	8	—	2,765	1,869	896
22	1,052	696	481	240	49	6	—	2,524	1,748	776
23	1,038	691	430	196	29	4	—	2,388	1,729	659
24	1,024	677	384	152	16	2	—	2 255	1,701	554
25	1,011	651	338	110	10	—	—	2,120	1,662	458
26	998	623	290	74	8	—	—	1,993	1,621	372
27	965	599	240	49	6	—	—	1,859	1,564	295
28	950	564	196	29	4	—	—	1,743	1,514	229
29	920	525	152	16	2	—	—	1,615	1,445	170
30	898	486	110	10	—	—	—	1,504	1,384	120
31	878	443	74	8	—	—	—	1,403	1,321	82
32	866	365	49	6	—	—	—	1,286	1,231	55
33	805	308	29	4	—	—	—	1,146	1,113	33
34	746	252	16	2	—	—	—	1,016	998	18
35	654	173	10	—	—	—	—	837	827	10
36	605	111	8	—	—	—	—	724	716	8
37	514	79	6	—	—	—	—	599	593	6
38	443	43	4	—	—	—	—	490	486	4
39	332	18	2	—	—	—	—	352	350	2
40	250	12	—	—	—	—	—	262	262	—
41	186	10	—	—	—	—	—	196	196	—
42	120	7	—	—	—	—	—	127	127	—
43	69	5	—	—	—	—	—	74	74	—
44	30	3	—	—	—	—	—	33	33	—
45–49	22	—	—	—	—	—	—	22	22	—

It is more convenient to have figures in 5-year groups of age at marriage. Therefore the figures in Table B relating to marriage ages under 20, 20–25, 25–30, etc., were averaged, using an appropriate set of weights (since the figures in Table B relate to "central" ages at marriage in the sense defined, the rates for age 25 are relevant to the computation of the figure for age at marriage 20–24, and so forth). The weights used were computed from the

(1) The first diagonal of Table A, which would relate to women whose central age at marriage is 16, has been omitted. It relates to a very small number of marriages and the rates are very inaccurate for the reason mentioned above.

(2) The word "fertility" is used here even though the rates are based on "maternities", whereas in accepted demographic terminology fertility refers strictly speaking to the production of a live birth

distribution of marriages in England and Wales in 1941 and 1942. Any other years would have given much the same result except for the group " under 20 ". It was desirable not to base the rates on the marriages of the years just before the war, because their distribution was somewhat abnormal owing to the fact that the survivors of the births of 1915–22 were in the prime marriageable age groups. It was assumed that the number of persons whose central age at marriage was x, was $\frac{1}{2}$ of those married at age $(x—1)$ plus $\frac{1}{2}$ of those married at age x.

The weights are given in Table C. The gross fertilities of marriage in 5-year age groups derived by their use are given in Table D for all the years 1939–44.

TABLE C

Weights for estimating fertility rates by Age at Marriage in Quinquennial Age Groups

Age Group	Central age at marriage	Weights
Under 20 ...	17	·07
	18	·21
	19	·44
	20	·28
	Total	1·00
20–24 ...	20	·10
	21	·23
	22	·24
	23	·20
	24	·16
	25	·07
	Total	1·00
25–29 ...	25	·14
	26	·26
	27	·22
	28	·18
	29	·14
	30	·06
	Total	1·00
Under 20 .	30	·14
	31	·25
	32	·21
	33	·18
	34	·15
	35	·07
	Total	1·00
35–39 ...	35	·13
	36	·24
	37	·20
	38	·18
	39	·17
	40	·08
	Total	1·00
40–44 ...	40	·13
	41	·24
	42	·23
	43	·21
	44	·19
	45	—
	Total	1·00

TABLE D

Gross Fertility of Marriages, 1939–44, in 5-year groups of age of wife at marriage, and 5-year groups of duration of marriage

(maternities per 1,000 marriages)

Year	Age at Marriage	Duration of Marriage (years)							
		0–4	5–9	10–14	15–19	20–24	25–29	30–33	Total
	Under 20	1,591	930	532	300	128	19	2	3,502
	20–24	1,121	604	359	185	43	5	—	2,317
	25–29	884	432	192	47	6	—	—	1,561
1939	30–34	758	269	46	6	—	—	—	1,078
	35–39	453	66	5	—	—	—	—	525
	40–44	122	11	—	—	—	—	—	132
	Under 20	1,346	801	517	278	119	18	2	3,082
	20–24	998	536	341	170	40	5	—	2,091
	25–29	795	380	176	44	6	—	—	1,400
1940	30–34	683	243	43	6	—	—	—	975
	35–39	414	60	5	—	—	—	—	479
	40–44	106	6	—	—	—	—	—	112
	Under 20	1,233	796	557	278	123	17	2	3,007
	20–24	896	497	340	172	41	5	—	1,953
	25–29	715	344	178	45	6	—	—	1,288
1941	30–34	650	227	44	6	—	—	—	926
	35–39	419	61	5	—	—	—	—	485
	40–44	113	8	—	—	—	—	—	121
	Under 20	1,229	841	556	302	131	18	2	3,079
	20–24	968	583	365	185	44	5	—	2,151
	25–29	830	439	192	48	6	—	—	1,514
1942	30–34	716	275	47	6	—	—	—	1,043
	35–39	439	67	5	—	—	—	—	512
	40–44	106	8	—	—	—	—	—	113
	Under 20	1,209	803	571	321	137	18	2	3,061
	20–24	987	627	388	195	46	5	—	2,247
	25–29	883	512	202	50	6	—	—	1,652
1943	30–34	681	277	41	5	—	—	—	1,004
	35–39	406	62	4	—	—	—	—	472
	40–44	127	8	—	—	—	—	—	134
	Under 20	1,276	861	659	388	156	19	2	3,362
	20–24	1,070	714	465	229	49	5	—	2,532
	25–29	967	589	239	53	6	—	—	1,854
1944	30–34	830	361	53	6	—	—	—	1,249
	35–39	489	77	5	—	—	—	—	571
	40–44	125	7	—	—	—	—	—	132

To convert the gross fertilities into net figures it is necessary to allow for the dissolution of marriages by death and divorce. A table was calculated showing the mean number of survivors in the first 5 years of marriage, the second 5 years of marriage, etc., out of marriages of wives in each age group. These figures are shown in Table E. They were obtained by first calculating the mean number of marriages surviving in the duration period mentioned if mortality at 1938–39 rates were the only cause of dissolution. This calculation was based on Table 4b of the Note on Rates of Dissolution of Marriage in England and Wales, 1938–39, printed elsewhere in this volume, it being assumed that the wife's age at marriage was precisely in the centre of each 5 year age group. Allowance was made for divorce in accordance with column (7) of Table 3 of that memorandum.

TABLE E

Mean number remaining in existence at various marriage durations (per 1,000 marriages contracted)

Age at Marriage	Duration						
	0–4	5–9	10–14	15–19	20–24	25–29	Over 30
Under 20 .	991	969	942	914	880	835	786
20–24	990	967	935	899	851	802	
25–29 .. .	989	961	920	870	818		
30–34 . ..	986	948	894	839			
35–39	980	928	868				
40–44	971	912					
45–49	975						

By multiplying each figure in Table D with the corresponding survival factor from Table E and adding the results, Table F was computed.

TABLE F

Net Fertility of Marriage (per 1,000)

Fertility Rates of 1939–44, Rates of Dissolution of Marriage by Death, 1938–39 and by Divorce, 1939

Age at marriage	1939	1940	1941	1942	1943	1944
Under 20	3,383	2,973	2,897	2,965	2,945	3,230
20–24	2,236	2,018	1,880	2,071	2,165	2,436
25–29	1,512	1,357	1,246	1,466	1,600	1,794
30–34	1,049	947	900	1,014	976	1,213
35-39	510	467	472	498	459	555
40–44	128	108	117	110	131	128

NOTE IV

THE COMPUTATION OF WEIGHTS PROPORTIONATE TO THE PRODUCTIVITY OF MARRIAGES IN THE *n*TH CALENDAR YEAR AFTER THEIR OCCURRENCE

The computation of the weights referred to in para. 53 is complicated by the fact that maternities in England and Wales are not tabulated by the calendar year in which the marriage of the parents occurred, but by the number of years which the marriage of the parents has lasted at the occurrence of the maternity. The weights were based on the 1939 tabulations. The following procedure was adopted. As a first step, the legitimate maternities registered in 1939 were multiplied by the ratio of legitimate live births occurring to legitimate live births registered in 1939. They were then related to the number of marriages occurring at a suitable period before as shown in the following table.[1]

TABLE A

Fertility Rates by duration of marriage, England and Wales, 1939

(1) Duration of Marriage [Completed Years]	(2) Legitimate Maternities Registered, 1939	(3) Estimated Legitimate Live Births occurring in 1939	(4) Period of Relevant Marriages	(5) Number of Marriages in Relevant Period	(6) Column (3) divided by Column (5)
0	91,518	89,470	July, 1938–June, 1939	357,256	·2504
1	81,924	80,091	July, 1937–June, 1938	362,644	·2209
2	66,287	64,804	July, 1936–June, 1937	355,104	·1825
3	56,623	55,356	July, 1935–June, 1936	350,212	·1581
4	48,985	47,889	July, 1934–June, 1935	348,436	·1374
5	40,545	39,638	July, 1933–June, 1934	331,996	·1194
6	32,645	31,915	July, 1932–June, 1933	305,796	·1044
7	28,363	27,728	July, 1931–June, 1932	311,176	·0891
8	24,815	24,260	July, 1930–June, 1931	310,100	·0782
9	21,737	21,251	July, 1929–June, 1930	320,365	·0663
10–14 ...	68,184	66,659	July, 1924–June, 1929	1,485,108	·0449
15–19 ...	31,963	31,248	July, 1919–June, 1924	1,629,091	·0192
20–24 ...	7,817	7,642	July, 1914–June, 1919	1,510,247	·0051
25–29 ...	980	958	July, 1909–June, 1914	1,375,711	·0007
TOTAL ...	602,386	588,909			

The total number of live births produced by 10,000 marriages subject throughout their existence to the fertility rates in the last column of the above table would be

$$2{,}504 + 2{,}209 + \ldots\ldots\ldots\ldots + 663 + (5 \times 449) + \ldots\ldots\ldots + (5 \times 7) = 17{,}563.$$

Next the rates at which marriages of calendar years previous to 1939 produced children in 1939 were estimated by interpolation from the rates in Table A. For example, the rate at which the marriages of 1934 had children in 1939 was estimated as the rate for a marriage duration of 4·5–5·5 years. The rates for individual duration were available, as the table shows, for the first 10 years of marriage. For higher marriage durations, the rates were

[1] The procedure used in this table, i.e., to relate maternities occurring at less than one year's marriage duration to the marriages occurring between the middle of the previous year and the middle of the current year and similarly for marriages of longer duration, is less refined than the process used by the Registrar-General in estimating the number of married women at various durations of marriage.

available in 5-year groups only. The rates for durations 5–9 were added together to give another 5-year value. Both sets of interpolations were based on second differences. For the first two years the tabulation of maternities to marriages of less than two years' marriage duration by 3-monthly periods made it possible to allocate the maternities in 1939 more precisely between those that occurred to marriages taking place in 1938 and those that occurred to marriages taking place in 1939. The resulting distribution of rates over marriages of recent years is similar to that found in cases where births have been tabulated by the year of the parents' marriage (Germany, Queensland).

The results of the process of interpolation are shown in the first column of the table below. The remainder of the calculation is self explanatory.

TABLE B

Derivation of weights from fertility rates by ' calendar ' duration of marriage, England and Wales, 1939

(1) Year	(2) Rate at which marriages in stated year produced births in 1939	(3) Ratio of spinster marriages under 45 to all marriages in year stated	(4) (2) ÷ (3)	(5) Weights per 1,000	(6) Difference between year of marriage and year of birth
1939 ...	109	·937	116	61	0
1938 ...	260	·929	280	148	1
1937 ...	198	·932	212	112	2
1936 ...	169	·936	181	96	3
1935 ...	147	·935	157	83	4
1934 ...	128	·935	137	72	5
1933 ...	112	·933	120	63	6
1932 ...	97	·931	104	55	7
1931 ...	83	·928	89	47	8
1930 ...	72	·927	78	41	9
1929 ...	63	·924	68	36	10
1928 ...	56	·923	61	32	11
1927 ...	48	·922	52	28	12
1926 ...	41	·920	45	24	13
1925 ...	34	·919	37	20	14
1924 ...	29	·915	32	17	15
1923 ...	25	·911	27	14	16
1922 ...	21	·903	23	12	17
1921 ..	17	·892	19	10	18
1920 ...	13	·879	15	8	19
1919 ...	10	·861	12	6	20
1918 ...	8	·877	9	5	21
1917 ...	6	·884	7	4	22
1916 ...	4	·901	4	2	23
1915 ...	2	·922	2	1	24
1914 ...	2	·921	2	1	25
1913 ...	1	·923	1	1	26
1912 ..	1	·926	1	1	27
TOTAL ...	1,756		1,891	1,000	

Since the original maternities are tabulated by the duration of the present marriage, it is not strictly correct to divide the rate attributed to each calendar year of marriage by the proportion of marriages of spinsters under 45, without reallocating the births to women who married for a second time to the calendar year of her first marriage. But the error involved is certainly negligible, for (1) the proportion of births occurring to remarried women is very small, and (2) the error is to some extent compensatory for each rate except the first.

The ratio of the legitimate births of each year from 1900–47 to the weighted average of the marriages of spinsters under 45 in the previous 27 years is shown below.

TABLE C

Legitimate births of each year related to weighted average of marriages of spinsters under 45 in previous 27 years, England and Wales, 1901–47

Year (1)	Weighted average number of marriages of spinsters under 45 in previous 27 years (2)	Number of legitimate births (3)	'Productivity of Marriage' (Col. (3) ÷ Col. (2)) (4)
1901	220,636	893,608	4·050
1902	223,815	903,835	4·038
1903	226,857	910,969	4·016
1904	229,275	907,715	3·959
1905	231,309	891,978	3·856
1906	233,912	897,691	3·838
1907	237,363	881,853	3·715
1908	240,069	902,852	3·761
1909	241,004	876,963	3·639
1910	242,015	860,327	3·555
1911	243,839	843,505	3·459
1912	246,221	835,209	3·392
1913	249,060	843,981	3·389
1914	251,921	837,000	3·322
1915	258,734	763,200	2·950
1916	265,397	743,700	2·802
1917	261,102	624,800	2·393
1918	257,744	601,700	2·334
1919	261,588	686,500	2·624
1920	271,810	913,900	3·362
1921	278,143	809,400	2·910
1922	277,715	741,100	2·669
1923	276,312	726,609	2·630
1924	275,459	699,637	2·540
1925	275,236	681,686	2·477
1926	274,182	664,972	2·425
1927	273,381	625,149	2·287
1928	275,147	630,565	2·292
1929	276,492	614,366	2·222
1930	278,871	619,129	2·220
1931	280,851	603,995	2·151
1932	281,938	586,961	2·082
1933	283,166	555,005	1·960
1934	286,714	571,857	1·995
1935	292,322	573,651	1·962
1936	297,764	580,397	1·949
1937	302,937	585,216	1·932
1938	307,644	594,825	1·933
1939	316,455	588,909	1·861
1940	333,182	564,487	1·694
1941	343,878	548,033	1·594
1942	343,400	615,036	1·791
1943	338,305	640,625	1·894
1944	327,756	696,305	2·124
1945	325,607	616,517	1·893
1946	330,584	766,800	2·320
1947	(332,623)	840,581	(2·527)

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